WORLD'S POULTRY SCIENCE JOURNAL

APRIL - JUNE, 1961

Volume 17 - Number 2

Official Organ of the
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Volume 17 April-June Number 2

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Published quarterly by the

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674 West Lane Avenue,
Columbus 10, Ohio, U. S. A.

Membership dues $3.00 a year of which $2.50 is for a year's subscription to the "World's Poultry Science Journal." Subscription rate, $3.50 a year. Advertising rates upon application.

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NUTRIENT REQUIREMENTS OF POULTRY

Reproduced from Publication 827, a report of the Committee on Animal Nutrition, National Research Council, National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D. C., U. S. A. Copies of this publication entitled "Nutrient Requirements of Animals, No. 1", are available from the Council's Printing and Publishing Office at the price of $1.00 per copy.

The Subcommittee on Poultry Nutrition of the National Academy of Sciences—National Research Council's Committee on Animal Nutrition was appointed in 1943 and charged with preparing nutrient-requirement standards for poultry. The first report of the subcommittee was published by the Academy Research Council in June, 1944. This has been revised at various times to take advantage of new findings of practical worth. The first revision of the tables of nutrient requirements was published in November 1946, a second in March 1950, and a third in January 1954.

Since 1954 new data have become available which necessitated revising the tables for a fourth time. In addition, valuable suggestions for improving the clarity, and thus enhancing the usefulness, of the tables have been received from persons working in the experiment stations and the commercial feed industry. The committee has attempted to incorporate these suggestions into the revised edition of the report.

The same general procedures were followed in making this revision as were used in compiling the original publication. The committee has attempted to evaluate the new data and at the same time keep in mind the data on which the original "Recommended Allowances" were based. Revised requirements listed in tables in this report are not to be considered as final. They will be further revised as new information of practical value on the quantitative requirements of poultry becomes available.

Nutrient requirements of chickens, turkeys, and ducks are given in Tables 1 to 4. Nutrient requirements of pheasants and quail are summarized for the first time in Tables 5 and 6.

Values given in these tables are based on the results of experimental work. Where several comparable experiments were available for consideration by the sub-committee, the values in the tables represent an approximate, but not necessarily an exact, average of the results.

Research workers conducting experimental work on the nutritive requirements of animals normally base their conclusions on the performance of groups of animals. Where performance is determined on the basis of gains in weight or feed efficiency, averages usually provide the basis for interpreting experimental work. Where deficiency symptoms are the criteria for determining nutrient adequacy or inadequacy, freedom from the deficiency syndrome of all animals in experimental groups is usually the basis of investigators' conclusions.

To make use of results of this character in preparing the tables of the *Nutrient Requirements of Poultry*, some calculations and interpolations were necessarily employed. Values, however, have not been increased by any intentionally added amounts, since the nature of the original findings indicate that they represent requirements which are adequate and which permit the maintenance of normal health and productivity of animals.

In practical feed formulations, it is often desirable to include margins of safety to compensate for possible losses of vitamins during the feed processing, transportation, and storage, and for variations in feed composition and in environment. Individual feed manufacturers can best evaluate their own situations and determine margins most suitable to their specific conditions.

It has been customary for research workers in poultry nutrition to express nutrient requirements in terms of concentration of nutrient per unit weight of ration and this method has been followed in the present report. This convenient method is somewhat inaccurate because the nutrient intake of the animal is thereby subject to the absolute level of the feed consumption, which in turn is dependent mainly on the energy concentration in the ration.

Protein and amino acid requirements are particularly subject to this effect, because they represent more nearly fixed quantities required per day at a given stage of growth or production, rather than percentages of the ration. In its simplest terms, the protein requirement bears a fairly constant relation to the energy concentration of the ration, dependent on the stage of life. That this is true in principle has been shown experimentally in several laboratories. However, even this means of expressing protein requirement does not lead to fixed values, apparently because of protein-sparing effects of

particular carbohydrate and fat combinations and other more obscure differences between rations.

Relative concentrations of protein and energy in the ration also have an important effect on the fat content of the body. In relative protein deficiency with ad libitum feeding, fat deposition is markedly increased. With higher protein levels relative to energy content, less fat is deposited. Increasing protein level above that required for maximum growth rate reduces fat deposition still further.

It is evident, therefore, that the protein requirement can be defined accurately only in relation to energy concentration, degree of fat deposition, and a limited range of nutrient combinations using those purified and practical feedstuffs which have been subjected to experimental study. For practical purposes in farm operations and feed manufacturing, sufficient work has been done with growing chicks to define, with reasonable accuracy, the minimum protein requirement for maximum growth rate in relation to energy level. Similar estimates can be made from more limited data for laying hens and growing turkeys.

Protein levels shown in Table 1 for chickens will meet the approximate minimum requirements for growth in rations containing 900 kilocalories of productive energy (Fraps) per pound, and for egg production in rations containing 920 kilocalories per pound. These energy levels are equivalent to approximately 1,300 kilocalories of metabolizable energy per pound.

Protein levels shown in Table 2 for turkeys will meet the approximate minimum requirements for early growth in a ration containing 800 kilocalories of productive energy per pound, and for later growth at an energy level of 850 kilocalories per pound. The equivalent metabolizable energy values would be approximately 1,140 and 1,200 kilocalories per pound.

When energy concentrations are used which are materially different from those on which the tables are based, proportionate changes in protein level will be necessary to maintain protein adequacy. The estimates apply primarily to rations based on natural feedstuffs customarily used in practical rations.

Requirements for vitamin A have been expressed in U.S.P. units of vitamin A activity per pound of feed. This is possible because in the chick as in the rat, 0.6 micrograms of

beta-carotene appears to be equivalent to one U.S.P. unit of vitamin A, except when the carotene intake provides vitamin A activity greatly in excess of the requirement.

Requirements for vitamin D have been expressed in International Chick Units per pound of feed inasmuch as chickens and birds generally use vitamin D_3 from fish oils

TABLE 1

Nutrient Requirements of Chickens[1]
(In Percentage or Amount per Pound of Feed)

	Starting chickens 0-8 weeks	Growing chickens 8-18 weeks	Laying hens	Breeding hens
Total protein, per cent	20	16	15	15
Vitamins				
Vitamin A activity (U.S.P. Units)[2]	1200	1200	2000	2000
Vitamin D (I.C.U.)[3]	90	90	225	225
Vitamn E	see text			
Vitamin K_1, mg.	*0.24*	?	?	?
Thiamine, mg.	0.8	?	?	?
Riboflavin, mg.	1.3	0.8	1.0	1.7
Pantothenic acid, mg.	4.2	4.2	2.1	4.2
Niacin, mg.	12	5.0	?	?
Pyridoxine, mg.	1.3	?	1.3	1.3
Biotin, mg.	0.04	?	?	?
Choline, mg.[4]	600	?	?	?
Folacin, mg.	0.25	?	0.11	0.16
Vitamin B_{12}, mg.	*0.004*	?	?	*0.002*
Minerals				
Calcium, per cent	1.0	1.0	2.25[5]	2.25[5]
Phosphorus, per cent[6]	0.6	0.6	0.6	0.6
Sodium, per cent[7]	0.15	0.15	0.15	0.15
Potassium, per cent	0.2	0.16	?	?
Manganese, mg.	25	?	?	15
Iodine, mg.	0.5	0.2	0.2	0.5
Magnesium, mg.	220	?	?	?
Iron, mg.	9.0	?	?	?
Copper, mg.	0.9	?	?	?
Zinc, mg.	20	?	?	?

[1]These figures are estimates of requirements and include no margins of safety. Italicized figures are tentative. See text.
[2]May be vitamin A or pro-vitamin A.
[3]See text.
[4]See text.
[5]This amount of calcium need not be incorporated in the mixed feed, inasmuch as calcium supplements fed free choice are considered as part of the ration.
[6]At least 0.45% of the total feed of starting chickens should be inorganic phosphorus. All of the phosphorus of non-plant ingredients is considered to be inorganic. Approximately 30% of the phosphorus of plant products is non-phytin phosphorus and may be considered as part of the inorganic phosphorus required. A portion of the phosphorus requirement of growing chickens and laying and breeding hens must also be supplied in inorganic form. For birds in these categories the requirement for inorganic phosphorus is lower and not as well defined as for starting chickens.
[7]Equivalent to 0.37 per cent of sodium chloride.

TABLE 2

Nutrient Requirements of Turkeys[1]
(In Percentage or Amount per Pound of Feed)

	Starting poults 0-8 weeks	Growing turkeys 8-16 weeks	Breeding turkeys
Total protein, per cent[2]	28	20	15
Vitamins			
Vitamin A activity (U.S.P.)[3]	2400	2400	2400
Vitamin D (I.C.U.)[3]	400	400	400
Riboflavin, mg.	1.7	?	1.5
Pantothenic acid, mg.	5.0	?	7.3
Niacin, mg.	32	?	?
Choline, mg.	850	?	?
Folacin, mg.	0.4	?	*0.35*
Minerals			
Calcium, per cent	2.0	*1.7*	2.25[5]
Phosphorus, per cent[6]	1.0	*0.85*	0.75
Manganese, mg.	25	?	15
Sodium, per cent[7]	0.15	0.15	0.15
Zinc, mg.	25	?	?

[1]These figures are estimates of requirements and include no margins of safety. Italicized figures are tentative. See text.
[2]The protein content of rations for growing turkeys from 16 weeks to market weight may be reduced to 16 per cent.
[3]May be vitamin A or pro-vitamin A.
[4]See text.
[5]This amount of calcium need not be incorporated in the mixed feed, inasmuch as calcium supplements fed free choice are considered as part of the ration.
[6]At least 0.50% of the total feed of starting poults should be inorganic phosphorus. All of the phosphorus of non-plant feed ingredients is considered to be inorganic. Approximately 30% of the phosphorus of plant products is non-phytin phosphorus and may be considered as part of the inorganic phosphorus required. Presumably a portion of the requirement of growing and breeding turkeys must also be furnished in inorganic form.
[7]Equivalent to 0.37 per cent of sodium chloride.

and irradiated animal sterol effectively but do not use vitamin D_2 from irradiated ergosterol as efficiently as do rats and other mammals. Vitamin D produced by irradiation of 7-dehydro-cholesterol may be more efficiently utilized by growing chicks and turkey poults than vitamin D from fish oils. This difference in the efficacy of the vitamin D from fish oils and irradiated animal sterols is particularly apparent when the ration is low in inorganic phosphorus. Turkeys are especially sensitive to the type of phosphorus present in the diet in relation to the type of vitamin D used. These factors have been considered in arriving at the recommended requirements for vitamin D, and the requirements listed are based on suggested minimum quantities of inorganic phosphorus. With the suggested amount of inorganic phosphorus, no difference in efficacy of vitamin D from fish oils and irradiated animal sterols should be observed in practice. The vitamin D requirement for

breeding turkeys are the same as that for growing poults because it is believed requirements for breeding turkeys are no less than for growing turkeys.

Requirements for all other vitamins and for the trace elements have been expressed in milligrams per pound, while the requirements for protein, calcium, phosphorus, potassium, and sodium have been given in percentage.

Betaine can be used interchangeably with choline in meeting the needs of the chicken for methylating agents but will not replace choline for its other functions, such as perosis prevention. Betaine appears to be widely distributed among practical feedstuffs and thus may be important in sparing choline. Likewise, vitamin B_{12} has been shown to reduce the requirement of the chick for choline. The figure for choline requirement given in Tabel 1 is intended to be applicable to conditions that would be encountered in practice.

The type of dietary carbohydrate has been shown to influence requirements of some of the water-soluble vitamins. Therefore, in establishing the requirements of these vitamins, greater weight was given to the results of experiments in which starch rather than one of the sugars was the principal dietary carbohydrate. This consideration was especially important in the case of folacin.

Requirements for vitamin E vary so much, depending on the nature of the diet, that it seemed inadvisable to include figures in Table 1. Chicks have been reared on purified diets very low in fat without any detectable vitamin E. Vitamin E requirement is increased by high levels of unsaturated fats and decreased by the presence of antioxidants. A part, but not all, of the biological function of vitamin E can be fulfilled by selenium.

Need for a minimum level of inorganic phosphorous is indicated in the footnotes to Tables 1 and 2. This need is based on the generally greater availability of inorganic phosphorous than of phytin phosphorus. Inorganic phosphorus supplements differ among themselves in availability, and it is important that the minimum level of inorganic phosphorus be provided in readily available form.

Experimental data have become available during the past several years which make it possible to give a more complete table of requirements for the essential amino acids. These requirements are given in Table 3.

TABLE 3

Essential Amino Acid Requirements of Chickens and Turkeys

Amino acid	Starting chicks Percent of ration	Starting poults Percent of ration	Laying of chickens Percent of ration
Arginine	1.2	1.6	?
Lysine	1.0	1.5	0.50
Histidine	0.3	?	?
Methionine	0.8	0.87	0.53
or			
Methionine[1]	0.45	0.52	0.28
Cystine	0.35	0.35	0.25
Tryptophan	0.2	0.26	0.15
Glycine[2]	1.0	1.0	?
Phenylalanine	1.4	?	?
or			
Phenylalanine[3]	0.7	?	?
Tyrosine	0.7	?	?
Leucine	1.4	?	1.2
Isoleucine	0.6	0.84	0.5
Threonine	0.6	?	0.4
Valine	0.8	?	?
For protein level	20.0	28.0	15.0

[1]Cystine will replace methionine for chicks as long as the ration contains not less than 0.45 per cent methionine.
[2]The chick can synthesize glycine but the synthesis does not proceed at a rate sufficient for maximum growth.
[3]Tyrosine will replace phenylalanine for chicks as long as the ration contains not less than 0.7 per cent phenylalanine.

This revision, like previous ones, gives tentative requirements for certain vitamins and minerals. In this revision, however, tentative values are listed in the same tables as the better established values and are distinguished by italic type. In a sense, all the values are tentative inasmuch as they are subject to revision as new data become available. The values marked "tentative" are those based on a limited number of observations as in the case of iron and copper, or on conflicting reports as in the case of vitamin B_{12}. Much of the disagreement on vitamin B_{12} requirements is undoubtedly the result of the chicken's ability to store this vitamin and transmit it from dam to offspring. Mutual sparing effects and other inter-relationships between vitamin B_{12} and other nutrients have probably also contributed to the disagreement. High levels of dietary fat have been reported to increase the chicks vitamin B_{12} requirement ten-fold. The subcommittee believes that the quantities of vitamin B_{12} given in the table should be furnished by animal protein supplements or vitamin B_{12} supplements. Although there are published reports assigning a low vitamin B_{12} potency to grains, alfalfa meal, and other

TABLE 4

Nutrient Requirements of Ducks[1]
(In Percentage or Amount per Pound of Feed)

	Starting and growing ducks
Total protein, per cent	17
Vitamins	
Vitamin D (I.C.U)[2]	100
Riboflavin, mg.	1.8
Pantothenic acid, mg.	5.0
Niacin, mg.	25
Pyridoxine, mg.	1.2

[1]These figures are estimates of requirements and include no margins of safety. Underlined figures are tentative. See text.
[2]See text.

TABLE 5

Nutrient Requirements of Pheasants and Quail[1]
(In Percentage or Amount per Pound of Feed)

	Starting and growing pheasants	Starting and growing quail	Breeding quail
Total protein, per cent	30[2]	28[2]	?
Vitamins			
Vitamin A activity (U.S.P. Units)[3]	?	*6000*	?
Vitamin D (I.C.U.)[4]	225	?	?
Niacin, mg.	22	?	?
Minerals			
Calcium, per cent	?	?	2.3
Phosphorus, per cent	*1.0*	?	*1.0*
Sodium, per cent[5]	0.085	0.085	?
Chlorine, per cent	0.11	0.11	?
Iodine, mg.	0.14	0.14	?

[1]These figures are estimates of requirements and include no margins safety. Italicized figures are tentative. See text.
[2]At energy of 750 Calories of productive energy per pound of feed.
[3]May be vitamin A or pro-vitamin A.
[4]See text.
[5]Equivalent to 0.21 per cent of sodium chloride.

products of plant origin, it is believed that these materials make no measurable contribution to the chicken's vitamin B_{12} requirement.

It is impossible, of course to give quantitative requirements for unknown dietary factors. Nevertheless, account must be taken of their existence. A diet that supplies the specified levels of the known nutrients but does not supply the unknowns is inadequate for best performance. There is evidence for four distinct growth factors in dried whey, marine and packing house by-products, distillers solubles and certain green forages. Whether these materials differ from each other in the nature of their organic factors is not

known. There is evidence for at least one unknown hatchability factor in fish solubles and green forage.

In recent years, several antibiotics have assumed an important place in poultry feeds because they increase growth rate and efficiency of feed utilization. They are not nutrients and it would not be appropriate to include them among the nutrient requirements. They appear to exert their effect upon the growth of the chicken by bringing about a change in the bacterial population of the digestive tract. Depending on the antibiotic used, 1 to 5 milligrams per pound of feed are needed to produce the desired effect.

SYMPTOMS OF NUTRITIONAL DEFICIENCIES IN CHICKENS AND TURKEYS

The more common gross pathological symptoms seen in poultry maintained on diets deficient in the various nutritional factors are herein described. One shortcoming of such a description is that the symptoms are observed, for some specific factor. Under these conditions only the acute symptoms develop, which, in most cases, are quite characteristic for each nutritional factor, thus making a diagnosis relatively easy. On the other hand, the gross symptoms observed in chronic deficiency of any of several factors may be similar (perhaps only retarded growth, ruffled plumage, etc.), thus making an accurate diagnosis difficult if not impossible. The chronic deficiency may be more serious in the long run than the acute, since diagnosis and treatment of the latter condition may be readily obtained while the chronic deficiency continues to exist because of failure to diagnose it.

Vitamin A

On a severely deficient diet the symptoms of vitamin A deficiency in chicks begin to appear in approximately three weeks. Growth is markedly retarded and the chicks show general weakness, emaciation, staggering gait, and ruffled plumage. Resistance to infection is reduced and mortality is increased. The secretions of the intestinal mucous glands, the tear glands, and the salivary glands fail. An opaque appearance caused by keratinization of the third eyelid may be observed. Infection may occur, resulting in the production of a viscous fluid which may cause the eyelids to stick together.

Pathological lesions observed on autopsy are confined largely to the mucous membranes of the mouth, pharynx, esophagus, and respiratory and urinary systems. Creamy white

pustules often are found on the roof of the mouth and along the esophagus, sometimes extending into the crop. Urates accumulate in the ureters and in the kidney tubules, causing these organs to become enlarged and creamy white in color. This urate accumulation is detected easily on gross examination because of its whitish appearance.

In mature fowl, the symptoms noted for chicks may develop much more slowly, but the eye disorder often becomes more acute. A cheesy exudate from the eyes often is observed, as well as a sticky discharge from the nostrils. Egg production and hatchability are markedly reduced.

Symptoms of vitamin A deficiency in turkey poults are, in general, similar to those described for chicks but are usually much more acute.

Vitamin D

A lack of vitamin D in the absence of direct sunlight results in the nutritional deficiency termed rickets. The chicks are retarded in growth, show a disinclination to walk or walk with a lame, stiff-legged gait, and have an ungainly manner of balancing the body. The chicks appear generally unthrifty. In this disorder an upset occurs in the mechanism involving the absorption and retention of calcium and phosphorus, as a result of which these minerals are not deposited in normal amounts in the bony structure of the body. Abnormal bone development may be detected most readily in the legs and at the junction of the ribs on the sides of the breast. The spinal column may be curved, and the sternum usually shows acute lateral bending or depression. Enlargement of the hock joints and beading of the rib ends becomes apparent. The beak is soft and rubbery and may be easily bent.

Inasmuch as vitamin D is concerned in calcium and phosphorus absorption and retention, a deficiency of either of these mineral elements may cause symptoms somewhat similar to those described for vitamin D deficiency. Grossly the symptoms may not be distinguishable one from another, except that the legs appear normal in phosphorus deficiency. Under practical conditions, however, vitamin D is the factor usually lacking, because a deficiency of calcium or phosphorus hardly ever becomes so acute as to bring about these symptoms.

In mature laying birds, the first symptom of a vitamin D deficiency is the laying of thin-shelled eggs, followed very shortly by decreased egg production. The breast bone becomes

soft and rubbery, and the bones of the legs and wings become fragile and easily broken. Birds may temporarily lose the use of their legs and squat in a "penquin-like" manner, a symptom which sometimes has been called "egg-paralysis." Hatchability is markedly reduced.

Symptoms of vitamin D deficiency in turkeys are very similar to those described for chickens.

Vitamin E

A lack of vitamin E in the ration of growing chicks results in the condition known as nutritional encephalomalacia. Chicks with this deficiency disease suddenly become prostrated, lying with legs outstretched and toes flexed. The head is retracted and often twisted laterally. Before the chicken becomes completely prostrated, its gait and other movements are often incoordinate. Upon autopsy, lesions are found in the cerebellum and sometimes in the cerebrum. In many chicks, necrotic reddish or brownish areas on the surface of the cerebellum can be seen by inspection. Under some conditions vitamin E deficiency results in subcutaneous edema and edema of the heart and pericadium.

In mature fowls, a prolonged vitamin E deficiency results in sterility in the male and reproductive failure in the female. Degenerative changes in the testes of the male may occur, resulting in permanent sterility. In females, egg production apparently is not affected by a vitamin E deficiency, while hatchability is reduced markedly. During incubation the rates of growth and differentiation are slow, and many embryos die during the first two days of development because of a circulatory failure. A definite critical period in the development of the embryo occurs about the fourth day.

Vitamin E deficiency in poults is known as nutritional myopathy. This condition is characterized by lesions in the muscular wall of the gizzard. These lesions appear as circumscribed gray areas, which often are of firmer texture than normal muscle and in some instances suggest presence of scar tissue.

Vitamin K

A lack of vitamin K greatly delays the clotting time of the blood, and chicks fed a deficient ration may bleed to death from any injury or bruise which causes rupture of blood vessels. Hemorrhages may occur subcutaneously, intramuscularly, intraperitoneally, or in any part of the chick's body.

The hemorrhages vary in size and appear to be the only symptom of the deficiency.

Mature birds do not seem to be subject to the acute vitamin K deficiency, indicating that they may synthesize the vitamin to some extent. It has been shown, however, that laying birds fed a vitamin K-low diet produce eggs low in vitamin K. When these eggs are incubated, chicks are hatched which have very low reserves of vitamin K with an accompanying prolonged blood-clotting time. As a consequence the chicks may bleed to death from an injury such as may result from wing-banding.

Thiamine

Day-old chicks when placed on a thiamine-low ration develop polyneuritis within 9 to 12 days. In the acute stage of polyneuritis the head may be drawn over the back. Diets containing suboptimal amounts of thiamine, when fed to chicks, lead to loss of appetite, emaciation, impairment of digestion, general weakness, and frequently to convulsions.

Symptoms of thiamine deficiency in mature birds and turkeys are similar to those described for chicks.

Riboflavin

A lack of riboflavin in the diet of young chicks results in diarrhea, retarded growth and paralysis of the legs, sometimes called curled toe paralysis. It involves the legs and feet and occurs in two stages, a preliminary stage which is curable and an acute stage which is incurable. Nutritional paralysis is characterized by the sudden appearance of chicks walking on their hocks, with toes curling inward; otherwise, the chicks appear to be in excellent health. Chicks receiving rations only partly deficient in riboflavin often recover spontaneously. In severe cases of the paralysis the brachial and sciatic nerves show very marked hypertrophy and softening which are usually discernible by inspection. The symptoms are quite pronounced and most often observed in the sciatic nerve. The nerves occasionally reach a diameter of four to five times the normal size.

Riboflavin deficiency in breeding birds results in poor hatchability. The requirement for hatchability is considerably higher than that for egg production and maintenance of health. The embryos that fail to hatch as a result of a riboflavin deficiency are dwarfed and show a high incidence of edema, degeneration of the Wolffian bodies, and a character-

istically defective down development, termed "clubbed" down. On a ration moderately deficient in riboflavin, many embryos die during the second week of incubation. The mortality reaches a peak about the eleventh day of development.

Pantothenic acid

Pantothenic acid deficiency in young chicks results in retarded growth, and feather development is extremely ragged. Within 12 to 14 days the eyelids become granular and stick together as a result of a viscous exudate. Crusty scabs appear at the corners of the mouth and around the vent. Dermatitis of the feet sometimes is observed in pantothenic acid deficiency, though the lesions are seldom as severe as those brought about by a biotin deficiency. Liver damage and changes in the spinal cord may be seen on post-mortem examination.

Lesions in adult fowl similar to those of growing chicks have not been observed although a deficiency of pantothenic acid results in lowered hatchability.

Niacin

A deficiency of niacin in the diet of chicks results in "black tongue," a condition characterized by inflammation of the tongue and mouth cavity. Beginning at about two weeks of age, the entire mouth cavity, as well as the upper part of the esophagus becomes distinctly inflamed with a deep red color in contrast to the normal pink of healthy chicks. Growth is retarded and feed consumption reduced. Poor feather development and occasioanlly scaly dermatitis of the feet and skin are also observed.

Turkey polts fed a diet deficient in niacin develop a hock disorder similar to perosis. The same condition can be produced somewhat less readily in chicks.

Vitamin B_6

Chicks fed a vitamin B_6-deficient diet show a small initial gain, then cease to grow or grow very slowly. Some chicks show abnormal excitability and, somewhat later, jerky convulsive movements. Chicks may suddenly run about aimlessly, often flopping their wings and keeping their heads down. Convulsions may occur and during these convulsions the chick may rest on its breast, raise its feet off the floor, and flop its wings. Chicks may fall on their sides or roll over on their backs and rapidly paddle their feet. The head often jerks up and down or retracts as in polyneuritis and sometimes moves convulsively in an up-and-down movement with the neck dis-

tended or twisted. Complete exhaustion follows such convulsions and is frequently fatal.

Vitamin B_6 deficiency in mature birds is characterized by loss of appetite, followed by rapid loss of weight and death. Egg production and hatchability are markedly reduced.

Choline

Retarded growth and perosis indicates lack of choline in the diet of young chickens and turkeys (See Manganese). Choline deficiency in mature birds has been reported to result in increased mortality and lowered egg production, with an increased abortion of egg yolks from the ovaries. More recently, however, experiments reported from two laboratories have indicated that choline may be synthesized by the laying hen in quantities adequate for egg production.

Biotin

Biotin deficiency in chicks results in a dermatitis somewhat similar to that observed in pantothenic acid deficiency. Lesions first appear in about three weeks, although considerable variation in time of appearance has been noted. The bottoms of the feet become rough and calloused and hemorrhagic cracks appear. The toes may become necroti and slough off, but the top of the foot and the leg usually show only a dry scaliness. Mandibular lesions which first appear in the corners of the mouth spread to include the area around the beak. Eyelids eventually become swollen and stick together. In contradistinction to these symptoms, the lesions in pantothenic acid deficiency are first evident in the corners of the mouth and eyes, and only in extreme cases do the lesions of the feet become so severe.

Biotin has been reported to be one factor necessary for the prevention of perosis in chicks and turkeys. Turkey poults exhibit symptoms very similar to those described for chicks when fed a biotin-deficient ration.

When feeding mature fowl a biotin-deficient ration causes reduced hatchability while egg production is not adversely affected. This indicates that the requirement of biotin for producing hatching eggs is much higher than that necessary for maintaining good health and egg production. In hens, dermatitis similar to that of chicks fed biotin-deficient rations has not been observed.

Folacin

Folacin deficiency in young chicks results in retarded growth, poor feathering, and, in colored chicks, feather depig-

mentation. These symptoms are accompanied by the development of an anemia which is characterized by a reduction in number of red blood cells and hemoglobin. The red cell size and the hemoglobin content of the cells, however, are increased. The red blood cells are also abnormally shaped and less fragile than normal.

Vitamin B_{12}

Vitamin B_{12} has been shown to be essential for chick growth. No specific symptoms have been described which can be attributed to a vitamin B_{12} deficiency. However, growth and hatchability are markedly reduced. There is a marked carry-over of the vitamin from the breeding hen to the young chick and mortality may be high among chicks deficient in the factor at hatching time.

Calcium and Phosphorus

Calcium, phosphorus, and vitamin D are closely interrelated in bone formation. A deficiency of any of these results in rickets, although the blood picture may vary, depending on the factor that is lacking. Retarded growth and increased mortality are also symptoms of calcium and phosphorus deficiency.

Manganese

A manganese deficiency in the diet of growing chicks and poults results in perosis or slipped tendon. As has been mentioned, perosis may also be caused by a deficiency of choline or biotin.

Perosis is a malformation of the bones of chicks. The symptoms usually observed are swelling and flattening of the hock joint with subsequent slipping of the Achilles tendon from its condyles. The tibia and the tarsometatarsus may exhibit bending near the hock joint, and lateral rotation. One or both legs may be affected. A shortening and thickening of the long bones of the wings and legs is also observed. The disorder, insofar as manganese is concerned, is aggravated by excessive quantities of calcium and phosphorus in the ration.

In laying and breeding birds, a manganese deficiency results in lowered egg production, egg shell strength, and hatchability. Numerous embryos that die as a result of manganese deficiency exhibit chondrodystrophy, a conddition characterized by a parrot-like beak, wiry down, and shortening of the long bones. This condition is not, however, specific for manganese deficiency.

Magnesium

When fed a diet deficient in magnesium, chicks grow slowly for about one week, then cease growing and become lethargic. When disturbed they exhibit symptoms similar to those of other species fed diets deficient in magnesium. Chicks show a brief convulsion, then go into a comatose state which sometimes terminates fatally but usually ceases in a few minutes.

Iodine

Iodine deficiency in the chick's diet results in goiter. The thyroid gland increases to many times the normal size. Histological examinations of the enlarged thyroid glands show an absence of colloid and a hyperplasia of the living cells of the follicle.

Iron and Copper

Anemia is the result of an iron and copper deficiency in the chick's diet. This type of anemia is characterized by a reduction in the hemoglobin content of the blood and a reduction in size of the red blood cell. A reduction in number of red cells, however, does not usually occur.

Zinc

In zinc deficiency, growth is retarded and feather development is extremely poor. The long bones of the legs and wings become shortened and thickened and the hocks enlarged. Slipped tendon, however, does not develop as in manganese deficiency but bone ash is at times slightly reduced. Occasionally the skin on the foot pads becomes dry and thickened and fissures in the epidermis which penetrate into the subcutaneous tissue develop. The principal lesion is that of hyperkeratosis.

COMPOSITION OF FEED INGREDIENTS AND FEED REQUIRED FOR PRODUCTION

Previous revisions of this report contained tables of composition of ingredients commonly used in poultry feeding. These were included to facilitate the formulation of feeds that would satisfy the nutrient requirements. Such tables were omitted from this revision in the interests of economy. The reader is referred to Publication 659 of the Academy—Research Council, "Joint United States-Canadian Tables of Feed Composition."

Feed Required for Production of Meat and Eggs

Data showing the approximate quantities of feed required for the production of eggs are presented in Table 6. Data on the quantities of feed required and the time required to attain

TABLE 6

Feed Required by Chickens of Different Live Weights for Maintenance and for the Production of 0, 100, 200, and 300 eggs, respectively, per year

Average Live weight	Average Total Feed Required per Bird per Year for Maintenance and the Production of the Indicated Number of Eggs			
	0 Eggs per Year	100 Eggs per Year	200 Eggs per Year	300 Eggs per Year
Pounds	Pounds	Pounds	Pounds	Pounds
3.0	47	61	75	89
3.5	52	67	81	95
4.0	57	71	85	99
4.5	61	75	89	104
5.0	65	80	94	108
5.5	70	84	98	112
6.0	74	88	102	116
6.5	78	92	106	120
7.0	81	96	110	124

certain weights in chicks and turkeys are given in Tables 7 and 8. The figures given are typical values for the breed represented. Considerable variation from the figures given may result because of strain variation, the amount of feed wasted, and quality of feed. They are presented to serve as a guide in estimating the amount of feed required for a given purpose.

DAILY REQUIREMENTS

The daily nutrient requirements for light and heavy breeds of chickens, presented in Tables 9 and 10, were computed from values given in Tables 1 and 7 of this report. It is hoped that these figures will be of value in studies on comparative nutrition. By expressing the requirements for all species and types of farm animals on a uniform basis, any basic relationships in their nutritive requirements will be made apparent.

SUMMARY

An attempt has been made to bring together in a condensed report information regarding the nutritional requirements and the symptoms of nutritional deficiencies of poultry. It is believed that the report will be useful to all who are concerned with the formulation and manufacture of poultry rations and with the teaching of poultry nutrition. County agricultural agents, high school teachers, and feedmen, who do not have library facilities or the time to study the original reports in the literature will also find it useful in answering questions regarding nutritional problems of poultry.

The dietary requirements should serve as a yardstick in determining the adequacy of any particular ration, at least for the better known nutritional factors. It should be emphasized,

TABLE 7

Feed Required and Time Required to Obtain Certain Average Live Weights with Common Breeds of Chickens

Average live weight	Kind of chicken and quantity of feed required per bird (lb.)				Kind of chicken and age at which certain live weights are reached (weeks)			
	White Leghorns		Heavy Breeds		White Leghorns		Heavy Breeds	
	Females	Males	Females	Males	Females	Males	Females	Males
0.5	1.0	0.9	0.9	0.8	3.0	2.7	2.8	2.5
1.0	2.3	2.0	1.9	1.8	5.4	4.7	4.4	4.1
1.5	3.7	3.2	3.1	2.9	7.6	6.4	5.7	5.2
2.0	5.3	4.7	4.5	4.2	9.7	7.8	7.0	6.3
2.5	7.1	6.3	6.1	5.5	12.1	9.0	8.3	7.3
3.0	9.7	8.2	7.8	6.9	14.6	10.4	9.5	8.2
3.5	13.2	10.6	10.0	8.5	17.5	12.0	10.8	9.1
4.0	20.8		12.4	10.2	20.9		12.0	10.0

TABLE 8

Feed Required and Time Required to Obtain Certain Average Live Weights with Two Common Breeds of Turkey

Average live weight	Kind of turkey and quantity of feed required per bird (lb.)				Kind of turkey and age at which certain live weights are reached (weeks)			
	Beltsville Small white		Broad-Breasted Bronze		Beltsville Small White		Broad-Breasted Bronze	
	Females	Males	Females	Males	Females	Males	Females	Males
Pounds	Pounds		Pounds		weeks	weeks	weeks	weeks
0.5	0.6	.6	.6	.6	2.5	2.2	1.9	1.7
1.0	2.0	1.9	1.5	1.5	4.5	4.0	3.3	3.1
2.0	4.9	4.5	3.5	3.2	7.0	6.3	5.3	4.9
3.0	7.9	7.1	6.0	5.2	9.1	7.9	6.6	6.2
4.0	10.9	9.6	8.5	7.8	10.9	9.3	7.8	7.3
5.0	14.1	12.4	11.2	10.2	12.7	10.7	9.1	8.2
6.0	18.4	15.1	14.4	12.7	14.6	11.8	10.3	9.1
8.0		21.6	21.2	18.2	20.5	14.0	12.7	10.7
10.0		29.5	30.0	24.7		16.3	15.1	12.3
12.0		41.1	40.9	31.6		19.6	17.5	13.9
14.0			53.3	38.5			20.3	15.7
16.0			70.1	46.3			24.4	17.3
18.0			94.8	54.4				18.9
20.0				63.5				20.7
22.0				72.9				22.3

TABLE 9

Daily Nutrient Requirements per Animal
(S.C. White Leghorns or similar breeds)

	Growing Animal						Mature Animal		
							Maintenance	Laying 60% Production	Breeding
Body weight, lb.	0.5	1.0	1.5	2.0	2.5	3.0	4.0	4.0	4.0
Total daily feed, lb.	0.056	0.095	0.119	0.139	0.161	0.189	0.156	0.241	0.241
Crude protein, lb.	0.011	0.019	0.024	0.022	0.026	0.030	?	0.036	0.036
Calcium, gm.	0.25	0.43	0.54	0.63	0.72	0.85	?	2.46	2.46
Phosphorus, gm.	0.15	0.26	0.32	0.38	0.43	0.51	?	0.66	0.66
Sodium, gm.	0.037	0.064	0.081	0.094	0.108	0.127	?	0.16	0.16
Potassium, gm.	0.050	0.086	0.108	0.101	0.115	0.136	?	?	?
Magnesium, mg.	12.3	20.9	26.2	?	?	?	?	?	?
Manganese, mg.	1.40	2.38	2.98	?	?	?	?	?	3.62
Iodine, mg.	0.028	0.048	0.060	0.028	0.032	0.038	?	0.048	0.120
Vitamin A, U.S.P. units	67.	114.	143.	167.	193.	227.	?	482.	482.
Vitamin D, I.C.U.	5.0	8.6	10.7	12.5	14.5	17.0	?	54.	54.
Thiamine, mg.	0.045	0.076	0.095	?	?	?	?	?	?
Riboflavin, mg.	0.073	0.124	0.155	0.111	0.129	0.151	?	0.241	0.410
Pantothenic acid, mg.	0.235	0.399	0.500	0.584	0.676	0.794	?	0.51	1.01
Niacin, mg.	0.67	1.14	1.42	0.70	0.80	0.95	?	?	?
Pyridoxine, mg.	0.073	0.124	0.155	?	?	?	?	0.31	0.31
Biotin, mg.	0.0022	0.0038	0.0048	?	?	?	?	?	?
Choline, mg.	33.6	57.0	71.4	?	?	?	?	?	?
Folacin, mg.	0.014	0.0238	0.298	?	?	?	?	0.027	0.039
Vitamin B_{12}, mg.	0.00022	0.00038	0.00048	?	?	?	?	?	0.00048

TABLE 10

Daily Nutrient Requirements per Animal
(Chickens of the Heavy Breeds)

	Growing Animal					Mature Animal		
							Laying	Breeding
						Maintenance	60% production	
Body weight, lbs.	0.5	1.0	1.5	2.0	3.0	5.5	5.5	5.5
Total daily feed, lbs.	0.074	0.119	0.152	0.178	0.213	0.192	0.276	0.276
Crude protein, lb.	0.015	0.024	0.030	0.036	0.045	0.029	0.041	0.041
Calcium, gm.	0.336	0.540	0.690	0.808	0.967	?	2.82	2.82
Phosphorus, gm.	0.201	0.324	0.413	0.484	0.579	?	0.751	0.751
Sodium, gm.	0.051	0.081	0.104	0.121	0.145	?	0.187	0.187
Potassium, gm.	0.068	0.108	0.138	0.162	0.194	?	?	?
Magnesium, mg.	16.3	26.2	33.4	39.2	46.9	?	?	?
Manganese, mg.	1.85	2.98	3.80	4.45	5.33	?	?	4.14
Iodine, mg.	0.037	0.060	0.076	0.089	0.107	?	0.055	0.138
Vitamin A, U.S.P. units	89.	143.	182.	214.	256.	?	552.	552.
Vitamin D, I.C.U.	6.7	10.7	13.7	16.0	19.2	?	62.1	62.1
Thiamine, mg.	0.059	0.095	0.122	0.142	0.170	?	?	?
Riboflavin, mg.	0.096	0.155	0.198	0.231	0.277	?	0.276	0.469
Pantothenic acid, mg.	0.31	0.50	0.64	0.75	0.89	?	0.58	1.16
Niacin, mg.	0.89	1.43	1.82	2.14	2.56	?	?	?
Pyridoxine, mg.	0.096	0.155	0.198	0.231	0.277	?	0.359	0.359
Biotin, mg.	0.0030	0.0048	0.0061	0.0071	0.0085	?	?	?
Choline, mg.	44.	71.	91.	107.	128.	?	?	?
Folacin, mg.	0.0185	0.0298	0.0380	0.0455	0.0533	?	0.030	0.044
Vitamin B_{12}, mg.	0.00030	0.00048	0.00061	0.00071	0.00085	?	?	0.00055

however, that the dietary requirements listed do not represent all of the nutritional factors required by poultry for optimum results. Other factors remain to be isolated and identified, and the requirements of poultry for these factors and their distribution in feedstuffs must then be determined.

A brief description of the more common gross pathological symptoms that are observed in poultry receiving nutritionally incomplete diets has been included to aid in recognizing the nutritional deficiency diseases. Very probably some of these will never appear under practical conditions. On the other hand, deficiencies in vitamin A, vitamin D, riboflavin, and manganese may occasionally appear among growing chicks and breeding hens. It is hoped that the description of the symptoms will aid in early recognition and treatment of diseases resulting from nutritional deficiency.

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BY-PRODUCTS OF REFINING OF SOYBEAN OIL AS FAT SUPPLEMENTS IN PRACTICAL BROILER RATIONS*

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The early literature on the value of added fat in chick rations has been adequately reviewed in the recent reports of Arscott and Sather (1958), Rand *et al.* (1958), Vondell and Ringrose (1958), Carver (1959), Leong *et al.* (1959), Norris *et al.* (1959) and others. Most research on this subject has involved the use of either inedible animal fats or edible vegetable oils, ingredients not economically available to the poultry industry in most countries outside the United States. In Israel the production of soybean oil for human consumption and soybean oil meal for feeding purposes has reached impressive proportions, and by-products of this industry are readily available.

When this investigation was started we were not aware of any reports on the use of soybean soapstock, soybean lecithin or unextracted soybeans. During the course of this study Carew *et al.* (1959), Combs *et al.* (1959), Runnels and coworkers (1959a, 1959b) and Stephenson and Tollett (1959) published their work on unextracted soybeans for feeding purposes and Stephenson *et al.* (1959) reported their trials with soybean soapstock. The use of cottonseed soapstock has been mentioned earlier by Couch (1953) and by Naber and Morgan (1957), and had been studied in detail by Curtin and Raper (1956).

EXPERIMENTAL PROCEDURE

Three 10-12 week battery trials were conducted. The day-old chicks were randomly assorted into compartments (two compartments per story), of two-story, temperature-controlled, electric battery brooders, with raised wire floors. The rations were also assigned at random to the various compartments. At 5 or 6 (first trial only) weeks of age the chicks were transferred to one-story, large wire-cages and maintained there until termination of the experiment. Feed and water were given *ad libitum*. Growth and feed consumption data were obtained at weekly or two-weekly intervals.

Composition of the basal diets fed is described in Table 1. The finishing rations differed from these starter rations (fed

* Publication of the National and University Institute of Agriculture, Rehovot, Israel. 1960 Series No. 345-E.

until 6-8 weeks of age) in that 3% fish meal and 5% soybean oil meal were replaced by 7.5% ground sorghum and 0.5% dicalcium phosphate. Every diet was fed to 4 replicates of 15-20 chicks each (according to trial) until their transfer to finishing cages, where the number of replicates was halved by combining every 2 groups on the same diet. The 9 fatty supplements employed were as follows:

1. Prime tallow—imported from the U.S.A.
2. American feed oil—methyl esters of vegetable fat (Marcol B-75).
3. Crude soybean oil.
4. Crude soybean lecithin.
5. Regular, untreated soybean soapstock (soapstock is the by-product obtained from the refining of any vegetable oil).
6. Acidulated soybean soapstock (the product of complete acidulation and thorough settling of soapstock, also referred to as hydrolyzed vegetable fat).
7. Acidulated soapstock and crude lecithin in equal proportions.
8. Soybean oil meal containing 10% crude soybean oil —the oil had been incorporated into the meal at the factory. This oiled meal was fed as 26% of the ration (instead of 23% regular, dehulled soybean meal and 3% fat).
9. Processed unextracted soybeans—this meal was produced at a modern soybean mill, and passed all stages of commercial continuous processing (including flaking), except for dehulling and extraction. It contained 37.5% crude protein and 18.6% crude fat, and was fed as 36% of the ration (instead of soybean meal plus 6% added fat).

Trial 1 was intended as an exploratory test using a variety of fatty products and by-products, with tallow and a commercial feed oil as positive controls. Trial 2 was undertaken mainly as a confirmation of the data obtained for soapstock in the preceeding test. The main purposes of trial 3 were to test (a) whether supplementary methionine would improve the beneficial effects of soapstock, and (b) what would be the effect of a higher level of soapstock. Consequently the 4 concentrations of soapstock (0%, 3%, 6% and 10%) were each fed with and without additional methionine.

TABLE 1

Composition of starter rations (percent)

Ingredients	Added Fat 0%	3%	6%	10% [1]
Fish meal (60% protein)	6.0	6.0	6.0	6.0
Soybean meal (49% protein)	20.0	23.0	26.0	29.5
Ground sorghum (milo)	63.0	57.0	51.0	43.0
Fat supplement	0.0	3.0	6.0	10.0
Wheat bran	5.0	5.0	5.0	5.0
Alfalfa meal (dehydr.)	3.0	3.0	3.0	3.0
Oyster shell flour	1.4	1.4	1.4	1.55
Dicalcium phosphate	1.0	1.0	1.0	1.10
Mineral supplement[2]	0.3	0.3	0.3	0.35
Vitamin supplement[3]	0.25	0.3	0.3	0.35
Antioxidant (B.H.T. 125 gm/kg)	0.10	0.1	0.1	0.10
Coccidiostat ("Bifuron")	0.10	0.1	0.1	0.10
DL-Methionine[1]	0.070	0.075	0.080	0.085
Calculated Analysis:				
Crude protein	21.3	22.1	22.9	23.8
Prod. energy (Cal./100 gm)	203	210	218	227
Cal./100 gm: Protein ratio	9.56	9.53	9.50	9.53

[1] Used only in 3rd trial
[2] Table salt containing manganese and trace elements
[3] Supplying per ton of feed: vitamin A 7.5 million I.U., vitamin D_3 0.9 million I.C.U., riboflavin 5 gm, calcium pantothenate 11 gm, niacin 20 gm, choline chloride 150 gm, vitamin B_{12} 8 mg, vitamin K 2 gm, and procaine penicillin 4 gm.

TABLE 2

Results of first trial
(Unsexed White Rock × Leghorn chicks, hatched Feb. 2, 1959)

Fat supplement	% fat (analyzed)	6 weeks of age[1] Weight (gm)	Feed conversion[2]	80 days of age[3] Weight[4] (kg)	Feed conversion[3]
Control (no added fat)	2.5	570.2	2.31	1.378	3.33
3% American feed oil	5.2	604.8	2.16	1.461	3.18
3% Tallow	4.9	602.4	2.16	1.427	3.14
3% Crude soybean oil	4.9	612.7	2.15	1.430	3.17
Oiled soybean meal	5.1	612.6	2.11	1.430	3.14
6% Acidulated soapstock	7.3	600.7	2.03	1.423	3.05
6% Soapstock: lecithin mix	7.1	615.7	2.03	1.447	3.05
6% Crude soybean oil	6.9	622.6	2.02	1.460	3.01
Unextracted flaked soybeans	8.5	606.6	1.98	1.399	2.92
L.S.D. (0.01)		—	0.08	—	0.05

[1] Average of 4 replicates, each containing 18-20 chicks
[2] Average of 2 replicates, each containing 37-40 chicks
[3] Kilograms of feed to produce 1 kg live weight
[4] Mean value of the averages for males and females

RESULTS

Trial 1

The data obtained in this trial are summarized in Table 2. With regard to growth rate, it is obvious that all experimental diets exceeded the control ration (devoid of added fat). Remarkable is the relative uniformity of weights obtained with all rations containing supplementary fat, irrespective of the type of supplement or its quantity. At 6 weeks of age the average additional weight gain amounted to approximately 7.5% and to about 4.1% at 80 days; in neither case was this increase statistically significant.

Results of feed/gain ratio are obvious and consistent, and are directly related to percent fat in the various diets. Thus 3% fat supplement caused an average improvement (over the control ration) of 6.5% at 6 weeks of age and of 5.1% at 80 days of age, while the improvements due to a 6% supplement were 12.1% and 8.7% respectively. All improvements were highly significant at the 1% probability point.

Trial 2

Main results of this trial are presented in Table 3. As far as growth rate is concerned, the rations containing fatty supplements (except the untreated soapstock) were uniformly superior to the control diet (without added fat) irrespective of type and quantity of fatty addition. The difference amounted to about 3.4% (not significant) at 5 weeks of age, but at the age of 10 weeks it reached approximately 5.1% (significant at the 5% level of probability). At the latter age there was no difference among the average weights of pullets on different diets, however, the growth response of the cockerels on the fat supplements was so pronounced that it significantly affected the mean weight of both sexes combined.

Results of feed conversion are very clear-cut: excluding the regular soapstock (which again proved useless), fat supplements at a 3% level improved feed conversion by an average of 5.6% at the age of 5 weeks, and by approximately 6.0% at 10 weeks of age ($P<0.01$); while the respective figures for 6% acidulated soapstock were 10.0% and 9.4% (a further highly significant improvement).

Mortality (and forced culling) did not exceed 3% in any of the lots, except in those fed rations containing untreated soapstock (in them it reached about 10%).

TABLE 3

Results of second trial
(Unsexed broiler-type chicks, hatched Sept. 24, 1959)

Fat supplement	% fat (analyzed)	5 weeks of age[1]		8 weeks of age[2]		10 weeks of age[2]	
		Weight (gm)	Feed conversion	Weight (kg)	Feed conversion	Weight[3] (kg)	Feed conversion
Control (no added fat)	3.1	521.8	1.80	1.062	2.25	1.480	2.65
3% untreated soapstock	4.7	519.2	1.77	1.095	2.20	1.507	2.64
3% lecithin	6.2	536.1	1.72	1.135	2.13	1.541	2.53
3% acidulated soapstock	6.1	538.8	1.71	1.121	2.11	1.558	2.47
3% American feed oil	5.8	543.7	1.68	1.145	2.09	1.564	2.47
6% acidulated soapstock	8.7	541.8	1.62	1.130	2.01	1.557	2.40
L.S.D. (0.01)		—	0.09	—	0.06	0.048	0.07

[1] Average of 4 replicates, each containing 14-15 chicks
[2] Average of 2 replicates, each containing 28-30 chicks
[3] Mean value of the averages for males and females

TABLE 4

Results of third trial
(Sexed broiler-type chicks, hatched Feb. 25, 1960)

Acidulated soapstock %	Additional methionine %	% fat (analyzed)	5 weeks of age[1]		8 weeks of age[2]		10 weeks of age[3]	
			Weight (gm)	Feed conversion	Weight (kg)	Feed conversion	Weight[3] (kg)	Feed conversion
0	0.0	2.0	550.4	1.87	1.149	2.43	1.592	2.70
	0.070		539.2	1.90	1.165	2.39	1.625	2.71
3	0.0	5.5	585.5	1.84	1.213	2.33	1.665	2.60
	0.075		590.6	1.77	1.214	2.29	1.687	2.59
6	0.0	8.0	594.5	1.79	1.236	2.27	1.677	2.53
	0.080		639.4	1.70	1.289	2.18	1.741	2.45
10	0.0	12.0	580.5	1.76	1.241	2.17	1.685	2.48
	0.085		624.6	1.65	1.281	2.11	1.732	2.40
L.S.D. (0.01)[4]			36.1	0.10	0.048	0.07	0.047	0.12

(1) Average of 4 replicates, each containing 15-16 chicks
(2) Average of 2 replicates, each containing 29-32 broilers
(3) Mean value of the averages for males and females
(4) L.S.D. (0.05) for feed conversion at 5, 8 and 10 weeks of age were 0.07, 0.05 and 0.09, respectively.

Trial 3

Table 4 summarizes the results obtained in this experiment. Taking into account first the data obtained in the absence of supplementary methionine, the accelerated growth rate obtained with rations containing acidulated soapstock is very obvious and highly significant ($P<0.01$) for all ages and both sexes, amounting to 6.5%, 7.0% and 5.3% at 5, 8 and 10 weeks of age, respectively. As in both previous trials, it was independent of soapstock level in the rations, and produced very similar weights per age for all concentrations used.

The improvements in feed conversion, on the other hand, depended directly on the level of added soapstock. According to analysis of variance the improvements due to this fat supplement were very significant ($P<0.01$) at all ages, but on a percentage basis they were less than in the previous trials: 3.7%, 6.3% and 8.1% improvement for 3%, 6% and 10% soapstock, respectively, at 10 weeks of age.

When examining the results obtained from the addition of synthetic methionine to the diets (containing 6% fish meal), it becomes clear that this supplement, in the absence of added fat, was practically without any effect (except for a slight increase in weight at 10 weeks of age). With 3% soapstock in the diet, the improvement in feed conversion due to methionine at 5 and 8 weeks of age was more or less significant at the 5% level, but this benefit disappeared at the age of 10 weeks. However, with 6% or 10% soapstock in the ration (and its correspondingly higher levels of soybean oil meal), the improvements in rate of growth due to added methionine were highly significant ($P<0.01$), while those in feed conversion were on the borderline of significance.

The combined improvements due to higher levels of soapstock together with supplementary methionine were quite remarkable, i.e., at 10 weeks of age the difference between the unsupplemented control ration and the one containing 6% soapstock and 0.08% DL-methionine was an additional weight gain of 149 grams (9.3%) and an improvement in feed conversion by 0.25 (also 9.3%).

DISCUSSION

One of the surprising aspects of this study was the uniformity of results obtained from the different fat supplements employed (except for the regular, untreated soapstock). According to the data in Tables 2 and 3, prime tallow, crude

soybean oil, methyl esters of vegetable fats, acidulated soybean soapstock, and soybean lecithin have practically an equivalent nutritional value for chicks, with a tendency for crude soybean oil to be superior and for lecithin to be inferior. These results are in conformity with those of Naber and Morgan (1957), who reported that crude cottonseed oil and crude cottonseed soapstock were equivalent to white grease (when used as 4% of the diet), and with those of Carver (1959) and Runnels *et al.* (1959b), who found no difference between the effects of tallow and lecithin-soybean oil mixes (when fed as 4% or 7% supplements, respectively).

The uniformity of our data can be explained readily and more fundamentally on the basis of the research conducted by Renner and Hill (1958), who reported almost identical metabolizable energy values for feed grade tallow (3,230 Cal./lb.), acidulated soybean sopastock (3,150) and lecithin (3,060), while the value for degummed soybean oil was much higher (4,210). It is quite possible that the superiority of the latter over the other fatty materials can be felt only if all of them are used at relatively high concentrations, and, therefore, it was not apparent in our results for the 3% level, but could be recognized at the 6% level (Table 2, 10 weeks of age).

The success of toasted but unextracted soybeans in trial 1 is at variance with the reports by Runnels and co-workers (1959), but confirms the data of Combs *et al.* (1959), Stephenson and Tollett (1959) and of Carew *et al.* (1959). The latter and Runnels *et al.* (1959) stress the importance of the flaking process, which is needed to rupture the cells and make the oil available for digestion.

The relative inferiority of lecithin to acidulated soapstock, in trial II, might be accidental, and is not explainable on the basis of the data presented by Renner and Hill (1958). Couch (1953) considered beneficial the addition of lecithin to diets containing soapstock, but March and Biely (1957) and Runnels *et al.* (1959b) were not able to substantiate this observation with other fat sources.

The failure of regular untreated soapstock may be explained on the basis of its low fat content and relatively high concentration of "soap". It is obvious, therefore, that in the production of acidulated soapstock great emphasis must be placed on correcting this situation by thorough acidulation (for elimination of the "soap"), washing (for removal of the acid) and separation (of the wash-water from the fatty acids

and other lipids).

Among the many published reports on the effect of supplemental fat in chick rations, roughly only half mention an increased rate of growth, and of these only about half found the increase to be statistically significant. In the present study a decided growth promoting effect was in evidence with all fat supplements employed (except untreated soapstock), amounting to approximately 4%-5% at the end of each of the three trials, with no appreciable benefit from raising the level of added fat above 3%—as long as no additional methionine was supplied. In trial 3, however, chicks receiving both 6% soapstock and DL-methionine weighed significantly more at all ages than those on diets containing 3% soapstock (with or without supplementary methionine), indicating that with the type of ration used methionine quickly becomes the limiting factor, preventing full benefits from higher levels of soapstock. This additional growth response of the latter is in line with the results of the Cornell workers (Dam *et al.*, 1959, and Norris *et al.*, 1959) obtained with edible vegetable oils.

Research to date has not shown conclusively whether the growth promoting effect of fat supplements is due to (1) energy concentration (Baldini and Rosenberg, 1957, and Pepper *et al.*, 1960), (2) a specific metabolic effect of fats *per se* (Carew and Hill, 1958, 1959, and Scott *et al.*, 1958), (3) essential fatty acids (Reiser, 1950, and Bieri *et al.*, 1956), or (4) unidentified growth factors (Carver and Johnson, 1953, Arscott, 1956, Rand *et al.*, 1958, and Dam *et al.*, 1959).

In contrast to the growth-promoting effect, feed efficiency in the present study was always improved proportionately to the increase in fatty material in the diet—but subject to the law of diminishing returns in the absence of additional methionine. When the latter was supplied in the third trial, this limitation was eliminated up to a 6% level of soapstock. In the 3 trials described the improvement in feed conversion obtained from 3% of any fatty supplement ranged rom 4% to 6%, in full agreement with most reports on this subject. The results of Table 4 emphasize the importance of optimal composition of rations containing high levels of supplementary fat, and demonstrate the existence of an interrelationship between the methionine requirements of chicks and the energy (and protein) level of the diet, as proposed by Baldini and Rosenberg (1955), Rosenberg *et al.* (1955), Combs *et al.* (1955), March and Biely (1956), Rosenberg and Baldini

(1957), Leong *et al.*, (1959) and Nelson *et al.* (1960).

SUMMARY

The usefulness of several refining by-products of soybean oil as fat supplements for practical broiler rations were tested in 3 trials involving 1,592 chicks.

Prime tallow, methyl esters of vegetable fats, acidulated soybean soapstock, soybean lecithin, crude soybean oil and unextracted (but toasted) soybeans had a rather equivalent value under the conditions of this study. Regular, untreated soapstock is not fit for use with chicks.

All fat supplements (except untreatd soapstock) had a uniform growth promoting property, which at times was significant, irrespective of type of fat.

All fat supplements (except untreated soapstock) improved feed efficiency proportionally to the increased fat content of the rations.

With the rations used, levels of 6% and 10% acidulated soapstock were able to exert their full benefit only in the presence of supplemental methionine. In the absence of the latter, no additional growth response was obtained by increasing fatty supplements above 3%, and the additional improvements in feed/gain ratios were subject to the law of diminishing returns.

ACKNOWLEDGMENTS

The authors wish to express their gratitude to the directors of "Etz-Hazayith" Oil and Soap Industry for supplying the full-fat soybeans, soybean oil and refining by-products. They also appreciate the tallow obtained from "Izhar" Oil Industry of Israel Ltd. and Marcol B-75 from Nissen Preminger Ltd., who also supplied DL-methionine.

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EFFECT OF CROSSING ON SOME PRODUCTIVE CHARACTERS IN CHICKENS

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I GROWTH

As a branch of agriculture, poultry provides the farmer with a rapid continuous cash income, and serves as a source of animal proteins. Many attempts are now being exerted to bring the poultry industry to its real important position. These attempts are faced with feeding and managerial problems, and the choice of suitable breeds for the subtropical environmental conditions in countries like Egypt.

Growth is one of the complicated characteristics sought by the animal breeders for its economical importance. This phenomenon is governed by heredity and environment. Asmundson and Lerner[1] showed that body weight in fowl is determined by multiple genetic factors. Maw[2] suggested a sex linked gene in the inheritance of body size, but Smith and Jaap[3] found no evidence of sex linkage. The heritability of body weight at the broiler age ranged from 15 per cent[4] to 50 per cent,[5] while it was only 32 per cent at 22 weeks of age.[6]

Generally, crossbred weights exceed those of their parents.[7] However, it was found by Van Alabada[8] that crossbreds at the broiler age are intermediate in weight between their parents. The results, however, are largely influenced by the genetical constitution of the parental stock.[9] Inbreeding has no significant effect on body weight.[10] However, Glazener *et al.*[11] observed that for each 10 per cent inbreeding, there was a slight decrease in growth until 12 weeks of age.

MATERIALS AND METHODS

The present study had been carried out at the Dokki Poultry Farm, Ministry of Agriculture, Giza. Seven matings were done as follows:

Matings			*Abbreviationus*
males		*females*	
1. Fayomi	×	Fayomi	Fay
2. White Leghorn	×	White Leghorn	WL
3. Rhode Island Red	×	Rhode Island Red	RIR
4. White Leghorn	×	Fayomi	LF
5. Fayomi	×	White Leghorn	FL
6. Rhode Island Red	×	Fayomi	RF
7. Fayomi	×	Rhode Island Red	FR

Twenty females and two males were involved in each mating. Males were kept with females two weeks before collecting eggs for incubation. Out of the seven matings, a total of 891 eggs was collected during ten days. A total of 545 chicks hatched on January 31, from which 62 chicks were Fay, 57 WL, 63 RIR, 107 LF, 92 FL, 100 RF and 64 FR. During the brooding period (from 0 to 8 weeks), chicks were fed on a ration consisting of the following percentages: corn 20; corn glutin 20; extracted rice bran 5; wheat bran 8.5; rice starch by-products 10; decorticated cotton seed cakes 30; bone meal 2; calcium carbonate 1; sodium chloride 0.5 and mineral salt mixture 3; in addition to vitamins, antibiotics and animal proteins. Afterwards, the percentage composition of the ration was corn 20; corn glutin 20; extracted rice bran 20; wheat bran 18.5; rice starch by-products 10; decorticated cotton seed cakes 5; bone meal 2; calcium carbonate 1; sodium chloride 0.5; mineral salt mixture 3; plus vitamins, antibiotics and animal proteins, in addition to the green matter "Egyptian clover" (*Trifolium alexandrinum*). Animal protein source was added in the form of fresh liquid blood by the rate of a gallon per 100 pounds mash. Aurofac (Aureomycin 2 mg. + vit. B_{12} 2 mg./lb) was added in the rate of 3 kg. per ton of the starting ration until 8 weeks of age and 1 kg per ton mash afterwards. One kilogram of vitamin A and B mixture was added to one ton of the starting ration, while 1.5 kg of these vitamins were added to the ration given afterwards. 180 grams of magnesium sulphate were added for each ton of both rations. The crude protein in both rations were 20%. Chicks were weighed fortnightly until the twelfth week of age. Relative growth rate was calculated at a two week interval accord-

ing to the equation $\frac{W2-W1}{\frac{1}{2}(W1+W2)}$ [12].

RESULTS AND DISCUSSION

(a) *Absolute body weight*:

The body weights of the pure breeds were 25.8, 33.8 and 37.8 gms. at hatching for Fay, WL and RIR respectively. The crossbreds of Fay dams were lighter at hatching than those of WL or RIR dams. The RIR exceeded the WL until the fourth week of age, when the WL became heavier till the twelfth week. The Fay. had the lowest weights throughout the whole period. The FR chicks were the heaviest while the LF were the lightest among crossbreds during the first 12 weeks of age, the other two crosses were intermediate. Generally, the crossbreds having RIR blood exceeded those having WL blood progressively after the second week of age (Table 1).

TABLE 1

Average weight per bird from 0 to 12 weeks of age in the different breeds and crosses (Grams).

Breeds and crosses	Age in weeks							
	0	2	4	6	8	10	12	
Fay	25.8	26.7	91	160	239	346	461	480*
WL	33.8	68.8	122	217	302	404	503	475
RIR	37.8	76.5	120	193	278	349	480	458
LF	25.8	53.9	91	159	230	323	428	421
FL	36.4	66.1	106	177	263	361	476	506
RF	26.5	66.4	114	199	291	402	542	521
FR	37.8	70.6	117	204	295	405	574	569

* Average of 20 females at 12 weeks of age.

On comparing WL and Fay with their reciprocal crosses, WL chicks were the heaviest, followed by the FL chicks throughout the whole period. The Fay and the LF chicks had the same weights until the sixth week of age, when the Fay chicks excelled the LF ones till the twelfth week. Comparing RIR and Fay chicks with their two reciprocal crosses, the RIR and FR chicks were heavier than Fay and RF ones during the first four weeks. In the following four weeks, RIR, FR and RF had almost the same weights. During the last four weeks, the two crosses RF and FR became heavier than RIR. The Fay chicks showed the lowest weights throughout the whole period. The trends observed in the averages of both sexes at 12 weeks were also observed in the weight of females at the same age. However, body weights at sexual maturity

of th same females were 1043, 1477, 1891, 1233, 1211, 1302, and 1310 for Fay, WL, RIR, LF, FL, RF and FR respectively, indicating that RIR hens were the heaviest among the pure-breds and FR hens were the heaviest among crossbreds.

The effect of crossbreeding in increasing body weight at the broiler age was manifested by using RIR and Fay. On the other hand, when using the two light breeds, WL and Fay, this was not clear. It seems that, for broiler industry, it is advisable to use a heavy breed such as RIR with a light one as Fay. Crossing WL with RIR results in hybrid vigor at the broiler age too,[7] or the crossbreds may be as heavy as RIR.[13] The results will lend itself to state that crosses of Fay with heavy breeds are better for broiler production.

(b) *Relative growth rate*:

The highest relative growth rate was observed for the Fay chicks during the first two weeks, for the WL during the period from 2 to 6 weeks, for the Fay from the 6th to the 10th week and for the RIR during the last two weeks (Table 2). The two light breeds, Fay and WL showed faster growth

TABLE 2

Relative growth rate of chicks from 0 to 12 weeks of age

Breeds and crosses	Age in weeks					
	0-2	2-4	4-6	6-8	8-10	10-12
Fay	74.9	46.8	54.7	39.4	36.8	28.4
WL	68.2	55.7	56.3	32.6	28.8	22.0
RIR	68.7	44.6	46.2	36.2	22.6	31.6
LF	70.5	51.5	54.0	36.5	35.0	27.8
FL	58.0	46.7	49.9	39.0	31.4	27.5
RF	85.9	52.9	54.3	37.3	32.1	29.7
FR	60.5	49.2	54.4	36.4	31.5	34.6

rate than RIR until the tenth week of age. This may be due to differences in age at sexvual maturity. Godfrey *et al.*[14] found that age at sexual maturity affects body size as early as four or six weeks of age, and that the early matured birds grow faster than late ones. The RF birds had the highest rate among crossbreds during the period from hatching till the sixth week. All crosses had generally the same relative growth rate during the period from 6 to 10 weeks. The FR initiated the highest rate during the period from 10 to 12 weeks of age.

On comparing the Fay, WL and their reciprocal crosses, the Fay had the highest relative growth rate during the first two weeks and during the period from 6 to 12 weeks. During

the period from 2 to 6 weeks, the WL had the highest relative growth rate. When Fay and RIR are compared with their reciprocal crosses, the RF had the highest relative growth rate from hatching until the sixth week, when the Fay held the superiority until the tenth week. The FR had the highest rate during the period from 10 to 12 weeks of age.

(c) *Maternal effect*:

Egg size and its nutritive value as well as the temperature and humidity during incubation are the main environmental factors involved in the manifestation of chick's weight at hatching. In the present work, the hatching weight of the chick is mainly decided by the weight of its egg. Pope and Schaible[15] reported similar results. The growth impulses during the first weeks of age is greatly affected by the nutritive components available in the egg. The Fay chicks showed higher relative growth rate during the first four weeks of age than the WL or RIR chicks, as the Fay egg contain a higher percentage of yolk.[16] The same holds true with the crossbreds, as those hatched from the Fay eggs showed higher relative growth rates than their reciprocal crosses from WL or RIR dams. However, breed differences in growth rate during the first four weeks of life may also be due to differences in the optimum requirements of ambient temperature and humidity for the chick.

The maternal effect seems to end at the fourth week after hatching. In the present study, although the RF chicks were lighter than the FR ones at hatching, yet they reached about the same weights at the fourth week. The WL chicks were lighter than RIR at hatching, but both reached the same weights at the fourth week. However, Godfrey *et al.*[14] stated that the influence of egg size decreases rapidly after two weeks of age.

SUMMARY

The present work had been carried out on 545 chicks hatched from seven matings using three breeds; Fayomi, White Leghorn and Rhode Island Red in addition to four crosses of Fay with WL and RIR. Chicks weight at hatching was lower for the chicks of Fay dams (Fay, LF and RF) than the chicks of WL or RIR dams. The relative growth rate was generally higher for Fay during the broiler stage than WL or RIR. The crossbreds had intermediate rates between parents. The average weight of Fay chicks at 12 weeks of age was 460 gms. as compared with 503 gms. for WL and 480 gms. for

RIR. The RF and FR crosses showed higher weights at this age than their parents, while this was not true in the case of LF and FL crosses.

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II MEAT PRODUCTION

Meat production in chickens is influenced by a lot of factors of which are age, live weight and breed. Generally, carcass percentage and edible meat increase with the advancement of age, while giblets percentage decrease[1]. In turkeys, Harshaw and Rector[2] showed that the percentages of dressed weight, drawn weight and the relative quantity of breast muscles increased with age, while leg muscles percentages remained approximately unchangeable.

Breeds differ in dressing percentages.[3] Gawecki *et al.*[4] found that RIR breed had a higher dressing percentage than WL at 15 weeks of age. Carcasses of crossbreds usually grade better than their parents[5]. The crossbred cockerels have also better meat type than the parent of the lower type[6]. Gyles *et al.*[7] found that crossbreds exceeded purebreds in the percentages of dressed weight, eviscerated weight, drumsticks and thighs. Kaufman and Cancarczyk[8] stated that crossbreds generally have the highest meat-bone ratio of the pure breeds used. The male parent also exerts a greater influence than the female parent upon the breast conformation of the progeny[9].

MATERIALS AND METHODS

The general procedures and matings conducted in this experiment were previously described in Part I of this work.

The abbreviation system for the seven matings were also previously illustrated in Part I.

At ages of 12, 16, 20 and 24 weeks, three cockerels out of each mating at each age were used for slaughtering tests. Slaughtering continued for three consecutive days at each age, using one cockerel of every mating a day. Birds were weighed early in the morning before feeding, sacrificed, plucked, drawn and dissected. During the course of dissection, wet towels were wrapped around the birds to minimize evaporation. The eviscerated carcass (neck, wings, back, breast, legs and giblets) and the total edible yield (breast meat, legs meat and giblets) were weighed. The giblets included the empty gizzard, liver, heart, spleen and kidneys.

RESULTS AND DISCUSSION

(a) *Body weight*:

At 12 weeks of age, WL cockerels were the heaviest followed by RIR with Fay last. At 24 weeks, however, the Fay cockerels were the lightest followed by WL and RIR being the heaviest. All crossbred cockerels showed higher average weights than Fay at all ages of study, except the weight of LF at 24 weeks. The FR cross showed the highest body weights among crossbreds at 12 weeks, while the RF had the advantage of 24 weeks of age (Table 1).

(b) *Eviscerated weight*:

The Fay eviscerated weight at 12 weeks of age was the lowest, while the WL was the highest. The weight of the eviscerated FR carcass was the highest, while the LF was the lowest among crossbreds at the age of 12 weeks. In all the matings carcass weight increased with age (Table 1.) At 24 weeeks of age, Fay had the lowest eviscerated weight while the RIR had the highest. Among the crossbreds LF had the lowest and RF had the highest.

The eviscerated carcass percentage was about the same for all the pure breeds at the twelfth week of age (about 63%). Meanwhile, at this age the LF and FL showed lower percentages than their parents, while the RF and FR had higher percentages than the pure Fay and RIR. The eviscerated carcass increased gradually with age. The highest rate of increase in this percentage was of the WL crosses, while the RIR crosses showed less response. Pure breeds showed intermediate rate of increase (Table 1).

(c) *Edible weights*:

TABLE 1

Average body weight, eviscerated weight and eviscerated percentage for the breeds and crosses

Breeds and crosses	Items	Age in weeks			
		12	16	20	24
Fay	Body wt. (Gm.)	518.	741.	1058.	1148.
	Evisc. wt. (Gm.)	325.	488.	717.	781.
	Evisc. %	62.7	65.9	67.8	68.0
WL	Body wt. (Gm.)	615.	976.	1180.	1610.
	Evisc. wt. (Gm.)	386.	619.	783.	1104.
	Evisc. %	62.8	63.4	66.4	68.6
RIR	Body wt. (Gm.)	600.	911.	1078.	1726.
	Evisc. wt. (Gm.)	375.	592.	712.	1153.
	Evisc. %	62.5	65.0	66.0	66.8
LF	Body wt. (Gm.)	575.	811.	1125.	1120.
	Evisc. wt. (Gm.)	342.	516.	751.	753.
	Evisc. %	59.6	63.6	66.8	67.3
FL	Body wt. (Gm.)	616.	938.	1293.	1351.
	Evisc. wt. (Gm.)	370.	611.	878.	922.
	Evisc. %	60.0	65.2	67.9	68.3
RF	Body wt. (Gm.)	595.	795.	1275.	1595.
	Evisc. wt. (Gm.)	380.	491.	868.	1088.
	Evisc. %	64.0	61.8	68.1	68.2
FR	Body wt. (Gm.)	660.	1148.	1483.	1528.
	Evisc. wt. (Gm.)	424.	751.	1016.	1062.
	Evisc. %	64.3	65.4	68.5	69.5

Edible weights of Fay cockerels at 12 weeks was the lowest, while the highest was that of WL. Among crossbreds, the FR had the highest edible weight at this age and the LF had the lowest. At the 24th week of age, the Fay edible weight was the lightest and the RIR was the heaviest. At this latter age, the RF among crossbreds showed the highest edible weight while the LF showed the lowest (Table 2).

The edible weight as a percentage of live weight was higher for Fay at the age of 12 weeks, than for both WL and RIR. At this age, the RF showed the highest edible percentage of live weight among cross breeds. This percentage increased gradually with age. At the age of 24 weeks, the Fay cockerels had the highest edible/live weight per cent, while RIR had the lowest. At this latter age, the FR, among crossbreds, showed the highest percentage and the LF had the lowest one.

The edible weight as a percentage of eviscerated carcass was higher for the Fay among the pure breeds at 12 weeks of age. LF and FL crosses showed higher percentages than RF and FR. This percentage increased with age until 24 weeks

TABLE 2

Average weight of edible parts and the percentage of edible parts to live weight and the eviscerated weight for the breeds and crosses.

Breeds and crosses	Items	Age in weeks			
		12	16	24	24
Fay	Edible wt. (Gm.)	164.6	260.8	380.2	415.6
	Edible/live wt. %	31.8	35.2	35.9	36.2
	Edible/evisc. wt. %	50.7	53.4	53.0	53.2
WL	Edible wt. (Gm.)	181.2	315.5	391.4	572.2
	Edible/live wt. %	29.5	32.1	33.2	35.5
	Edible/evisc. wt. %	46.9	50.6	50.0	51.8
RIR	Edible wt. (Gm.)	176.5	300.6	347.2	586.6
	Edible/live wt. %	29.4	33.0	32.2	34.0
	Edible/evisc. wt. %	47.0	50.7	48.7	50.8
LF	Edible wt. (Gm.)	175.1	265.8	388.0	380.0
	Edible/live wt. %	30.1	32.7	34.5	33.9
	Edible/evisc. wt. %	50.6	51.5	51.6	50.4
FL	Edible wt. (Gm.)	185.6	319.8	459.7	485.3
	Edible/live wt. %	30.1	34.0	35.5	35.9
	Edible/evisc. wt. %	50.2	52.3	52.4	52.6
RF	Edible wt. (Gm.)	188.2	245.7	449.2	579.7
	Edible/live wt. %	31.6	30.9	35.2	36.3
	Edible/evisc. wt. %	49.4	50.0	51.7	53.2
FR	Edible wt. (Gm.)	204.7	389.2	523.4	558.6
	Edible/live wt. %	31.0	33.9	35.3	36.6
	Edible/evisc. wt. %	48.3	51.8	51.5	52.6

when it reached 53% for Fay, which was larger than WL and RIR corresponding percentages. The RF showed the highest percentage among crossbreds at the latter age, and the LF showed the lowest.

(d) *Breast weight*:

The heaviest breast weights are shown for WL at the first 3 ages, while it was for RIR at the last age. The crosses with RIR blood had the higher breast weights than those of WL blood. The breast meat accounted for 75.8% of the breast weight of the Fay cockerels at 12 weeks of age (Table 3), while it was only 70% and 70.8% for WL and RIR at the same age. This percentage increased gradually with age. At 24 weeks, the percentage of meat in breast was still higher for Fay than for WL and RIR. The percentage of meat in breast was higher for FL and FR than their reciprocal crosses throughout the ages of slaughtering. Breast meat weight showed the same trends like breast weight.

(e) *Legs weight*:

The legs weight and legs meat weight are shown to increase with the advancement of age (Table 4). Among pure

TABLE 3

Average weight of breast and breast meat and the percentage of meat in breast for the breeds and crosses.

Breeds and crosses	Items	Age in weeks			
		12	16	20	24
Fay	Breast wt. (Gm.)	59.5	91.8	147.1	166.8
	Breast meat wt. (Gm.)	45.1	73.8	122.0	137.4
	% of meat in breast	75.8	80.4	82.9	82.4
WL	Breast wt. (Gm.)	76.1	120.5	155.8	225.7
	Breast meat wt. (Gm.)	53.2	92.0	123.6	182.4
	% of meat in breast	70.0	76.3	79.4	80.8
RIR	Breast wt. (Gm.)	72.0	116.6	136.3	235.8
	Breat meat wt. (Gm.)	51.0	90.4	107.2	190.2
	% of meat in breast	70.8	77.6	78.7	80.7
LF	Breast wt. (Gm.)	68.3	97.1	152.2	146.8
	Breast meat wt. (Gm.)	51.2	72.4	121.7	108.4
	% of meat in breast	75.0	74.6	80.0	81.4
FL	Breast wt. (Gm.)	72.1	116.0	179.0	183.0
	Breast meat wt. (Gm.)	54.2	91.0	143.8	150.0
	% of meat in breast	75.1	78.5	80.4	82.0
RF	Breast wt. (Gm.)	78.2	92.9	174.8	233.8
	Breast meat wt. (Gm.)	57.8	68.8	143.7	191.3
	% of meat in breast	73.9	74.1	82.2	81.8
FR	Breast wt. (Gm.)	82.2	147.3	203.3	223.5
	Breast meat wt. (Gm.)	61.2	111.0	168.0	184.7
	% of meat in breast	74.5	75.4	82.2	82.6

breeds, the RIR showed the highest legs weight at 12 weeks and 24 weeks of age. However, the legs meat weight was slightly higher in Fay at 12 weeks than in WL and RIR, while the WL showed the heaviest legs meat weight at 24 weeks. As for crossbreds, the FR had the heaviest legs weight and legs meat weight at 12 weeks, and the RF held the advantage at 24 weeks. The percentage of meat in legs at the age of 12 weeks was higher in Fay than in WL or RIR. Crossbreds showed intermediate percentages of meat in legs at this age. This percentage is shown to increase gradually with age. At 24 weeks of age, the Fay, among purebreds, also showed the highest percentage of meat in legs while RIR showed the lowest. At this latter age, all the crossbreds showed almost the same percentages (about 81.3%).

(f) *Fleshing qualities*:

Fleshing of the cockerels varied in both pure breeds and crosses. The percentages of meat in breast and legs were markedly higher in the Fay cockerels than in both WL and RIR at the age of 12 weeks. This may be attributed to the breed differences in growth rate. Fay birds, having generally

TABLE 4

Average weight of legs and legs meat and the percentage of meat in legs for the breeds and crosses.

Breeds and crosses	Items	Age in weeks			
		12	16	20	24
Fay	Legs wt. (Gm.)	107.6	157.6	236.	262.
	Legs meat wt. (Gm.)	84.0	124.4	193.	216.
	% of meat in legs	78.1	79.0	82.0	82.2
WL	Legs wt. (Gm.)	114.6	202.1	254.	378.
	Legs meat wt. (Gm.)	83.4	154.2	199.	310.
	% of meat in legs	72.8	76.3	78.3	81.9
RIR	Legs wt. (Gm.)	116.2	189.8	231.	386.
	Legs meat wt. (Gm.)	83.4	147.3	175.	298.
	% of meat in legs	71.8	77.6	75.7	77.2
LF	Legs wt. (Gm.)	108.0	171.7	251.	260.
	Legs meat wt. (Gm.)	81.4	138.4	206.	210.
	% of meat in legs	75.4	80.6	81.3	81.0
FL	Legs wt. (Gm.)	112.5	195.5	295.	318.
	Legs meat wt. (Gm.)	83.8	157.2	239.	258.
	% of meat in legs	74.5	80.4	81.1	81.3
RF	Legs wt. (Gm.)	119.5	158.8	294.	376.
	Legs meat wt. (Gm.)	89.7	120.5	237.	306.
	% of meat in legs	75.1	75.9	80.7	81.4
FR	Legs wt. (Gm.)	131.5	256.0	344.	369.
	Legs meat wt. (Gm.)	97.7	200.1	274.	301.
	% of meat in legs	74.3	78.2	79.7	81.5

the fastest growth rate during the broiler stage, completed the skeleton development at an earlier age than did the other two breeds. The energy intake in Fay birds seemed to be almost directed towards meat formation. On the other hand, both WL and RIR used the energy in building up the skeleton on the expense of the late developing part, the meat.

After the broiler stage, however, the WL and RIR birds compensated for the retardation in meat development. At 24 weeks of age, differences among the pure breeds in the percentages of meat in breast were small, while the percentages of meat in legs were higher for the two light breeds Fay and WL than for the RIR.

The percentages of meat in breast and legs of the crossbreds birds were in between the corresponding percentages of their parents. This may indicate that additive genes are involved in the inheritance of the fleshing properties, although this influence needs further experiments. However, the crosses resulting from Fay males with either WL or RIR females had higher percentages of meat in breast than their reciprocals. This may suggest the existance of a paternal

effect in the fleshing properties of the breast. However, Maw and Maw[10] suggested a paternal effect in the breast conformation.

SUMMARY

Eighty four males were slaughtered. They were divided among 7 breeds and cross-types, and four ages, three at each group.

At 12 weeks of age, the eviscerated carcass percentages of cockerels were nearly the same for the three pure breeds (about 63%). The RF and FR crosses showed higher eviscerated carcass percentages than both parents (about 64%), while the LF and FL crosses had lower percentages (about 60%). The eviscerated carcass percentage increased with age. At the 24th week of age, it was higher for WL and Fay (about 68%) than for RIR. At this age, the crosses of RIR also showed generally higher percentages than those of WL.

The percentage of meat in breast was higher for Fay than for WL or RIR at the twelfth week and throughout the ages of slaughtering. The crossbreds showed intermediate percentages between parents.

The percentage of meat in legs was higher for Fay than for WL or RIR at the twelfth week of age, while it was about the same for Fay and WL at the 24th week (about 82%). It was only only 77% in RIR. Crossbreds showed intermediate percentages.

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BOOKS AND BOOKLETS

Second Report of the Joint WHO/FAO Expert Committee on Zoonoses. Published jointly by FAO and WHO and issued as World Health Organization Technical Report Series No. 169. 83 pages, 1959. Price: $1.00 or 5 shillings. (Payment to FAO sales agents may be made in local currencies)

Zoonoses is a term which includes those diseases which are naturally transmitted between vertebrate animals and man. This bulletin gives a good review of all aspects of the problem.

Trends in Phosphorus. Published in 1960 by Smith-Douglas Company, Inc., 5100 Virginia Beach Boulevard, Norfolk, Virginia, U.S.A. Copies available on request.

This booklet contains review articles on the place of phosphorus in animal nutrition. Each review was written by a specialist who has active research on the subject. Three reviews are concerned with poultry. These are: (1) Laying Hens; (2) Turkeys, Ducks, Geese and Pheasants; (3) Broilers.

A Bibliography of Farm Buildings Research, 1945-1958. Part III: Buildings for Poultry. Published in 1960 by The Agricultural Research Council Farm Buildings Unit, National Institute of Agricultural Engineering, Wrest Park, Silsoe, Bedfordshire, England. Price 4 shillings and 11 pence, postpaid.

This booklet contains 348 references with brief abstracts. The environmental needs of chickens, factors affecting the design and construction of chicken houses, and systems of housing investigated and compared. Buildings for turkeys and ducks are considered separately.

Marketing Poultry Products, 5th edition, 1960, by Earl W. Benjamin, James M. Gwin, Fred L. Faber and William D. Termohlen. Published by John Wiley & Sons, Inc., 440 Park Avenue South, New York 16, N. Y., U.S.A. 327 pages. Price: $7.75.

This 5th edition has been almost completely rewritten to provide an up-to-date text. It was planned primarily for use as a textbook for Vocational Schools as well as Universities. Automation, preparation and marketing of by-products, as well as handling, distribution and merchandising, are special features of this new edition. The discussion of the economics of poultry and egg marketing has been expanded. While the book is concerned with the marketing of poultry products in the U.S.A., it should be of interest to anyone associated with the poultry industry in all countries.

FIRST EUROPEAN POULTRY CONFERENCE
Utrecht, Netherlands, 15-18 November 1960

Chairman Prof. Dr. C. Romijn addressing the Conference. *Left to right:* Major Macdougall, Prof. Romijn, Dr. Rauch.

A View of the Conference

XII WORLD'S POULTRY CONGRESS

Countries Invited to Participate

The Commonwealth Government of Australia has issued invitations to 101 countries to be represented at the XIIth World's Poultry Congress to be held August 10-18, 1962, in Sydney. Also, invitations have been issued to additional independent States and Territories such as the Vatican City, Papus and New Guinea, the Northern Territory and Norfolk Island.

A number of countries have now formally advised acceptance of the invitation to be represented at the Congress by official delegates, the most recent acceptances being from the Government of the U. S. S. R., Netherlands and Denmark. Some countries have already nominated personnel.

Officials of the XIIth Congress

The complete list of Honorary Officials of the XIIth World's Poultry Congress has now been released. It is headed by the Patron, His Excellency the Rt. Hon. Viscount Dunrossil, G.C.M.G., M.C., Q.C.; Governor-General of the Commonwealth of Australia.

The Honorary Presidents are the Rt. Hon. R. G. Menzies, C. H., Q.C., M.P.; Prime Minister of Australia and the Hon. R. J. Heffron, M.L.A., Premier of the State of New South Wales. The President is the Hon. C. F. Adermann, M.P., Commonwealth Minister for Primary Industry.

Honorary Vice-Presidents are Mr. H. H. Alp, President of the World's Poultry Science Association; Hon. R. B. Nott, M.L.A., Minister for Agriculture, New South Wales; Alderman the Hon. H. F. Jenson, Lord Mayor of Sydney; Brigadier the Hon. T. A. J. Playfair, D.S.O., O.B.E., V.D., President of the Royal Agricultural Society of New South Wales; Dr. F. W. G. White, C.B.E., Chairman of the Commonwealth Scientific and Industrial Organization; Dr. R. B. Madgwick, Vice Chancellor of the University of New England and Representative of the Australian Vice Chancellor's Committee; Sir Edward Hallstrom, Kt., Executive Director of Taronga Park Zoological Trust.

Chairman and Vice-Chairman respectively are Mr. J. V. Moroney, C.B.E., Secretary of Commonwealth Department of Primary Industry and Mr. R. C. Blake, Chairman of the

Australian Egg Board. Secretary General is Mr. W. D. Hardy, B.Sc. Agr., H.D.A., Deputy Assistant Secretary of the Commonwealth Department of Primary Industry.

World Egg Marketing Conference

Following the conclusion of the XIIth World's Poultry Congress in Sydney in 1962, a further very important event for the world's poultry industry is now being planned. It has been deceided that the opportunity should be taken of the attendance of marketing leaders at the Congress to hold a conference of World Egg Marketing Authorities in the week following the Congress. As the Australian Egg Board is convening the Conference the Congress Organisation has decided to issue invitations to all World Egg Marketing Authorities to attend the Congress prior to the Marketing Conference.

An important and interesting agenda is being prepared and discussions will include amongst other items, the important one of marketing world egg surpluses and the possibility of establishing a world secretariat to prepare and distribute statistics of production and disposals. As this is the first occasion on which a world conference of Egg Marketing Authorities has been held it is possible that the names and addresses of all potential participants are not known to the convenors, and full details of the propsal will be forwarded to all Egg Marketing Authorities upon application to:

The Chairman, Australian Egg Board
263 Castlereagh Street
Sydney, New South Wales
Australia

Poultry Science Association to Award Congress Travel Grant

Poultry Science Association, a scientific organization in North America, has announced an 1,000 dollar travel grant to be awarded to its member who submits the best paper for presentation at the Congress. The recipient must be a member of Poultry Science Association, not over 45 years of age.

Dr. H. R. Bird, Chairman of the Award Committee, must have a title and synopsis of the paper by June 1, 1961. The full paper must be received by July 15, 1961. Full details of the competition were published in POULTRY SCIENCE, Vol. 40, No. 1, January, 1961, page 271.

NATIONAL COMMITTEE FORMED IN ITALY

Doctor G. Giordani, Secretary-treasurer of the Italian Branch of the World's Poultry Science Association, reports that a National Committee for the XIIth World's Poultry Congress has been formed in Italy. The purpose of the formation of the National Committee is to organize the national delegation and to maintain liaison with the Congress organization in Australia.

The formation and support of national committees ensure that the Congress will function as a truly representative world congress. National Committees also ensure that the requirements and wishes of all sections of the poultry industry in a country are brought to the attention of the Congress organization.

WPSA PRESIDENT HONORED

The president of the World's Poultry Science Association, H. H. Alp, received an honorary doctors degree from the University of Mexico in January, 1961. The citation, in Spanish, reads as follows:

"La Universidad Nacional Autonoma de Mexico ha tenido a bien designar al senor Dr. Herbert Howard Alp Professor Extraordinario"

The ceremony took place in the College of Veterinary Science of the University of Mexico. Dean Sarvide, who made the presentation, stated that this was only the second time that this degree has been conferred and the only one in the last twenty-five years. Dr. H. H. Alp now becomes an honorary member of the faculty of the University with the privilege of teaching and being subject to special call, lectures and similar duties.

REVIEW OF POULTRY PUBLICATIONS

(Abstracts from Animal Breeding Abstracts and from *Nutrition Abstracts and Reviews* are reproduced by arrangement with the Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England.

Acknowledgment is also made to Biological Abstracts, University of Pennsylvania, Philadelphia 4, Pennsylvania, U.S.A. for the Abstracts taken from *Biological Abstracts.)*

NUTRITION

AFIFI, M. Uber den Einfluss antibiotischer Wirkstoffe in verschiedenen Dosierungen auf Kukenwachstum und Futterverdaulichkeit. EFFECT OF ANTIBIOTICS IN DIFFERENT AMOUNTS ON GROWTH OF CHICKS AND DIGESTIBILITY OF FEED. *Arch. Geflugelk.*, 1959, 23, 404-408. (Inst. Tierzucht., Landwirtsch. Hochsch., Stuttgart-Hohenheim.)—Day-old White Leghorn chicks were fed to appetite for 8 weeks on a basal ration of maize 40, oats 10, wheat 10, wheat feed 5, tapioca meal 5, soya bean meal 22, fishmeal 6 and minerals 2 per cent., with vitamins. Some had aureomycin, penicillin or terramycin in amounts ranging from 5 to 50 mg. per kg. feed; control groups had none.

Chickens having aureomycin showed better weight gains, especially at the 25 mg. level, better feed utilisation and higher feed intake than the controls. Values for birds given penicillin, for which the optimum level was 40 mg., did not differ significantly from those of the controls. Terramycin did not significantly increase weight gain or feed intake. In another trial, with aureomycin 25, penicillin 40 or terramycin 25 mg., or no antibiotic, results were about the same for all four.

Digestibility of crude protein and N-free extract, estimated at the end of the 4th week, was about the same in all groups, but digestibility of crude fat was improved by aureomycin and penicillin, and up to the 4th week there was a significant positive correlation between digestibility of crude fat and feed utilisation. Terramycin did not improve digestibility of crude fat or, unlike the other antibiotics, weight at the end of the 4th week. It was concluded that improvement of feed utilisation by antibiotics was linked with digestibility of crude fat.—I. R. Anderson. (Nutrition Abstracts & Reviews)

AGCANAS, P. B. and A. G. NAVARRO. THE EFFECT OF ABRUPT CHANGE OF FEEDING ON THE EGG PRODUCTION OF DUCKS. *Philippine J. Animal Indust.*, 1958, 19, 125-130.—Half of each of 2 groups of 30 ducks, aged 5 months or 1 year, were given duck mash twice a day for the whole 12 months' trial period, and the other half were given duck mash alternating in periods of 15 days with snails to appetite, and palay once a day. The length of the periods was later changed to 3 months.

The average total and percentage egg production for the younger group on mash were 50.66 and 13.6 per cent. and on the alternating diet 192.35 and 60.0 per cent. For the older group on mash it was 61.18 and 16.8 per cent. and on the alternating diet 153.86 and 42.2 per cent.

Six ducks out of a total of 30 ducks given the alternating diet and 3 from those given mash throughout died during the trial. Leg weakness and prolapse of the oviduct were the causes.

Cost of feeds was lower and profits were higher when the alternating diet was given.—M. E. Falconer. (Nutrition Abstracts & Reviews)

ALLEN, JAMES R. (Univ. of Wisconsin Med. School, Madison, Wis.) EFFECTS OF TOXIC FATS IN CHICKENS. *Fed Proc.* 19(1 Pt. 1): 235. 1960—Abstract. (Biological Abstracts)

ARNOLD, M. H. M.

FIELD TRIALS OF CALCIUM LACTATE IN LAYING RATIONS. *Vet. Rec.*, 1960, 72, 215. (Bow-Calac Ltd., Moss Bank, Widnes.)—Results of 20 successful independent commerical trials, under different conditions, lasting at least 2 months and incorporating calcium lactate as 1 per cent. of the total feed, are summarised. In 7 trials there was an increase in egg production, up to 18 per cent., and a decrease in feed consumption, up to 12 per cent. In 4 trials there was an increase in egg production, up to 12 per cent., but no effect on feed consumption, and in 5 trials feed consumption decreased, up to 20 per cent. In 4 trials the calcium lactate had no effect. No adverse effect was seen in any trial.

Response was sometimes immediate and sometimes delayed and in 2 trials response followed only after the use of antibiotic. Th apparently uncertain effect of calcium lactate may be due to its action on intestinal microflora, reducing proteolysis and thereby increasing feed efficiency and thus affecting egg production or feed intake or both.—J. C. Gordon. (Nutrition Abstracts & Reviews)

ARSCOTT, G. H. and **R. J. ROSE.**

USE OF BARLEY IN HIGH-EFFICIENCY BROILER RATIONS. 4. INFLUENCE OF AMYLOLYTIC ENZYMES ON EFFICIENCY OF UTILIZATION, WATER CONSUMPTION AND LITTER CONDITION. *Poultry Sci.*, 1960, 39, 93-95. (Dept. Poultry Husb., Oregon State Coll., Corvallis.) For part 3 see Abst. 4488, Vol. 28.—4. Performance efficiency of broiler chickens reared to 8 weeks on a mash ration with 61 per cent. maize was compared with that of chickens on rations containing a similar amount by weight of barley. The barley rations were given as mash or pellets and for some groups were supplemented with enzymes or 3 per cent. fat or both.

Compared with the maize mash ration the barley mash depressed performance efficiency. Pelleting the barley mash improved efficiency but not to the level of that of the maize mash. Additions to the barley mash of enzymes with or without animal fat also improved performance efficiency but only when the barley ration was pelleted did efficiency equal that obtained with the maize mash. Water intake was increased by all the barley rations. Litter condition was excellent with the maize ration, good with barley rations containing enzymes but only poor to fair on rations without enzymes.—J. S. Thomson. (Nutrition Abstracts & Reviews)

BARTH, K. Wachstumsversuche mit dem Antibiotikum Oleandomycin bei Kuken.

GROWTH STUDIES ON CHICKENS WITH THE ANTIBIOTIC OLEANDOMYCIN. *Arch. Geflugelk.*, 1960, 24, 67-73. (Inst. Physiol. Ernahrung Tiere, Univ. Munich.) English summary.—Two trails were each with 480 chickens; for each diet there were 4 replicate groups of 15 birds. Basal diets were without or with animal protein and were given without antibiotic or with 5 mg. penicillin or 1, 2 or 4 mg. oleandomycin per kg. diet. The chickens were freely fed for 56 days, at first in batteries on wire floors and later in runs on straw. In the second test all weight gains were poorer than in the first, a difference ascribed to chronic respiratory disease.

In the first trial oleandomycin gave better weight gains than penicillin, and 2 mg. was as good as 4 mg. In the second trial the results were particularly good with 1 mg. Feed utilisation was improved by all supplements in the first trial, but in the second the improvement was noticed only on the diet with animal protein.—D. Duncan. (Nutrition Abstracts & Reviews)

BARTHOLOMEW, GEORGE A., and **RICHARD E. MacMILLEN.** (U. California, Los Angeles.)

THE WATER REQUIREMENTS OF MOURNING DOVES AND THEIR USE OF SALT WATER AND NaCl SOLUTIONS. *Physiol. Zool.*, 33(3): 171-178. 1960.—Studies of ad libitum consumption of distilled water, sea water dilutions, and NaCl solutions indicate that the mourning dove *(Zenaidura macroura marginella)* will freely drink and

is able to maintain positive water balance on solutions which are hypotonic to its body fluids, but not on solutions which are hypertonic. Consumption of distilled water averaged 10% of body weight per day. Drinking increased with concentration to 0.2 *M* NaCl and to 37.5% sea water and then decreased as higher concentrations were used. Body weight was maintained while drinking solutions up to 0.15 *M* NaCl and 25% sea water, but fell sharply on higher concentration. Tests of salinity discrimination showed that there was no preference among the various sea water dilutions upon which body weight could be maintained, but that above this level higher concentrations were rejected in favor of lower ones. When deprived of water the mourning doves lost weight at the rate of 5% of initial body weight per day. They are apparently unable to utilize succulent vegetation as a water source.—Author. (Biological Abstracts)

BLAMBERG, D. L., UNABELLE B. BLACKWOOD, W. C. SUPPLEE, and G. F. COMBS. (U. Maryland, College Park.)

EFFECT OF ZINC DEFICIENCY IN HENS ON HATCHABILITY AND EMBRYONIC DEVELOPMENT. *Proc. Soc. Exptl. Biol. and Med.*, 104(2): 217-220. Illus. 1960.—Purified hen diets containing isolated soybean protein and 3-28 ppm. Zn were supplemented with 120 ppm. Zn (as $ZnCl_2$) in an investigation of the role of Zn in the nutrition of the breeding hen. Hatchability of eggs from hens fed the Zn-supplemented diet was relatively uniform throughout the experiment, varying between 79% and 89%. When the Zn content of the unsupplemented basal diet was approximately 28 ppm, hatchability was erratic; but generally lower than that of eggs from the Zn-supplemented hens. Hatchability rapidly decreased to 0 when the Zn content of the basal diet was reduced to approximately 4 ppm. Examination of dead embryos from Zn-deficient hens revealed a characteristic skeletal malformation in which the dominant feature was some degree of impaired trunk and limb development, the caudal-most part of the vertebrae always being absent. These skeletal abnormalities were never observed in embryos from hens fed the Zn-supplemented diet. Chicks managing to hatch from Zn-deficient hens exhibited varying degrees of weakness.—Authors. (Biological Abstracts)

BOLTON, W.

POULTRY NUTRITION. *Minist. Agric. Fish. Food Bull.* No. 174, 1959, pp. v + 90. H.M.S.O., London. Price 5s. net.—This bulletin replaces "Scientific Principles of Poultry Feeding" by E. T. Halnan, now out of print (Abst. 5145, Vol. 18). Its aim is to provide the poultry farmer with up-to-date scientific information on which to base a successful feeding programme, and in this it succeeds admirably. It will also be of value to advisers in poultry nutrition and to compounders of feedingstuffs.

The processes of digestion and absorption and the nutritive constituents of feeds are dealt with clearly and concisely. A cautious attitude to antibiotics is wisely adopted. The general principles underlying the formulation of diets are discussed and there are useful tables of the composition of feeds and of the requirements of poultry for different nutrients as well as recommended mash formulae for different productive purposes.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

BRETTE, A. Les matieres azotees et l'energie dans l'alimentation du poulet de chair.

NITROGENOUS COMPOUNDS AND ENERGY IN FEEDING TABLE POULTRY. *Rev. Elevage, Paris*, 1960, 15, 449-450; 453-454. (Nutrition Abstracts & Reviews)

BRUGGEMANN, J., K. EPPINGER and H. ZUCKER. Untersuchungen uber die Eiweissqualitat von Sojaextraktionsschroten.

THE PROTEIN QUALITY OF SOYA BEAN OILMEALS. *Ztschr. Ernahrungswiss.*, 1960, 1, 31-39. (Inst. Physiol.Ernahrung Tiere, Univ. Munich.) English summary.—Chickens were given to appetite water and

a ration containing, per cent., maize 56.5, soya bean oilmeal 30.6, beef tallow 5.0, sugarless dried whey 2.0, dried fish solubles 1.0, minerals, vitamins and antibiotic. The protein quality, *i.e.*, effect on growth and feed efficiency, of 5 commercial soya bean oilmeals and 2 heat-treated meals, all produced in Germany, and of 2 meals from the United States was investigated. The German meals, except for one of the heated products, were on the whole inferior to the American meals. There was generally a close relation between urease activity and protein quality. DL-Methionine, 0.1 per cent., added to meals of low or medium quality, improved growth and feed efficiency. Less methionine had to be added to medium than to low quality meals.—I. R. Anderson. (Nutrition Abstracts & Reviews)

BRUGGEMANN, J., H. ZUCKER and **R. WEBER.** Untersuchungen zur Einsparung von Fischmehl und zur Sojaschrotqualitat.

SPARING OF FISHMEAL AND QUALITY OF SOYA BEAN MEAL. *Arch. Geflugelk.*, 1960, 24, 89-95. (Inst. Physiol. Tiere, Univ. Munich.) English summary.—A large number of trials were made with groups of from 10 to 20 chickens, so that there were in all 68 groups fed with and 68 without fishmeal, and tests were made of 8 different lots of soya bean meal sold as "toasted". In all tests chickens were fed for 56 days after hatching.

On the average in all tests the 8-week weights and feed utilisation were 6 per cent. better with fishmeal as 10 per cent. of the ration than without it, but in some tests there was no appreciable difference. The soya meals also varied widely in nutritive value.—D. Duncan. (Nutrition Abstracts & Reviews)

CLEGG, R. E., A. T. ERICSON and **U. K. MISRA.**

EFFECT OF HIGH LEVELS OF DIETARY CHOLESTEROL ON THE SERUM PROTEINS OF THE CHICKEN. *Poultry Sci.*, 1960, 39, 35-39. (Dept. Chem., Kansas Agric. Exp. Stat., Manhattan.)—Chickens 8 weeks old were given for 17 days a commercial growing ration with 3 per cent. cholesterol and 5 per cent. Wesson oil added, and then the ration without the supplements. Blood samples were collected at the start and on days 14, 17 and 26. Serum from the samples was compared with that from chickens given injections of 3 mg. diethylstilboestrol daily for 5 days and killed on the 6th day.

Chickens of both groups showed a rise of serum cholesterol and non-dialysable P but the rise of the P fraction was much greater with stilbestrol. The changes produced by the 2 treatments in the electrophoretic pattern of serum proteins were quite different. When chickens given the 2 treatments had injections of 3^{12} P the distribution of radioactivity between serum protein fractions also was different.—D. Duncan. (Nutrition Abstracts & Reviews)

COATES, M. E., M. K. DAVIES and **G. F. HARRISON.**

ANTIVITAMIN B_{12} ACTIVITY FOR THE GROWING CHICK AND DEVELOPING CHICK EMBRYO OF SOME ANALOGS OF CYANOCOBALAMIN. *Arch. Biochem. Biophys.*, 1960, 87, 93-99. (Nat. Inst. Res. Dairying, Univ. Reading.)—Methylamide, ethylamide and anilide of mixed monocarboxylic acids derived from cyanocobalamin by mild hydrolysis were tested with depleted chicks of both sexes in groups of 10 to 12 for antagonism to vitamin B_{12} administered simultaneously. Both vitamin and antagonist were given by intramuscular injection twice weekly for 3 weeks. The anilide analogue showed the greatest antagonistic effect; that of the other 2 amides was very slight, and in very small doses they seemed to have some vitamin B_{12} activity. When the anilide was given 24 hr. after vitamin B_{12} it had little effect. With chicks not previously depleted of vitamin B_{12} the anilide had no antagonistic effect towards the vitamin.

The anilide given alone reduced hatchability of depleted chick embryos and completely prevented any effect of vitamin B_{12} given simultaneously; it had little effect on normal embryos. The ethylamide had slightly less effect than the anilide. There was some evidence that the anilide was ineffective when given 24 hr. after vitamin B_{12}.

It is suggested that although certain analogues are antagonistic

towards free cyanocobalamin they are relatively ineffective against vitamin B_{12} in its physiologically active form in the animal body.—A. M. Copping. (Nutrition Abstracts & Reviews)

COOPER, J. B., T. L. MAXWELL (Jr.) and A. D. OWENS.
A STUDY OF THE PASSAGE OF WEED SEEDS THROUGH THE DIGESTIVE TRACT OF THE CHICKEN. *Poultry Sci.*, 1960, 39, 161-163. (Dept. Poultry Husb., S. Carolina Agric. Exp. Stat., Clemson.)—There was no evidence of viable weed seeds in droppings of hens given the seeds in autoclaved rations.—J. S. Thomson. (Nutrition Abstracts & Reviews)

COUCH, J. R. (Texas Agric. Expt. Sta., College Station.)
POTENTIATION OF BROAD SPECTRUM ANTIBIOTICS—A TECHNIQUE FOR INCREASED DRUG EFFECTIVENESS. *Western Feed and Seed.* 15(1): 26-28, 1960.—"Potentiation" of antibiotics means increasing their effectiveness by increasing their concentration in the blood stream. Feeding a low level of Ca to poultry will potentiate broad spectrum antibiotics. The Ca level in the feed formula should be between 0.2 and 0.35%. This formula should be used for 5 days with chicks and 1 to 3 days with laying hens.—J. F. Harrington. (Biological Abstracts)

CREEK, R. D., C. W. CARRICK, S. M. HAUGE and H. E. PARKER.
THE EFFECT OF TECHNICAL GRADE MANGANESE SULFATE ON VITAMIN STABILITY. *Poultry Sci.*, 1960, 39, 109-111. (Purdue Univ. Agric. Exp. Stat., Lafayette, Ind.)—Vitamin A, vitamin B_1, riboflavin, nicotinic acid, pantothenic acid and choline were estimated in a complete chick ration before and after storage for 4 months. Part of the ration had 200 p.p.m. Mn, as technical grade manganese sulphate, incorporated before storage.

Inclusion of Mn had no effect on the stability of the vitamins; 35 per cent. of vitamin A was lost in the ration without Mn, but no more with Mn. A chick feeding experiment showed that the stored ration with Mn had no ill effect on growth.

In a second trial a protein-vitamin concentrate without Mn or with 373 or 746 p.p.m. added Mn was stored for 4 months. The concentrate without Mn lost pantothenic acid 20, carotene 70 and vitamin B_1 up to 20 per cent., but no more was lost when Mn was added. The nutritive value for chicks was not impaired by the presence of Mn. There was no evidence of rickets.

It is suggested that considerably more carotene than the requirement should be included in rations that are to be stored for any length of time.—J. S. Thomson. (Nutrition Abstracts & Reviews)

CREGER, C. R., R. H. MITCHELL, R. L. ATKINSON, T. M. FERGUSON, B. L. REID and J. R. COUCH.
VITAMIN E ACTIVITY OF SELENIUM IN TURKEY HATCHABILITY. *Poultry Sci.*, 1960, 39, 59-63. (Dept. Biochem. Nutrit., Texas Agric. and Mech. Coll., College Station.)—Seven groups of Beltsville Small White turkey hens were kept for 9 weeks on a vitamin-E-deficient diet containing no source of unidentified substances. One group continued on the diet for the next 12 weeks and the others received a supplement of 5 per cent. dried brewer's yeast, or 0.1 p.p.m. Se, or both, or 10 I.U. vitamin E (D-α-tocopheryl acetate) per lb., or vitamin E combined with Se or with Se and dried brewer's yeast.

Fertility of eggs from the group on the unsupplemented diet was 62 per cent. With dried brewer's yeast or vitamin E, it rose to 74.3 and 82 per cent., respectively. Addition of Se depressed fertility to 56.4 per cent. With dried brewer's yeast and Se the increase was no greater than with yeast alone. Addition of Se to the vitamin E supplement depressed fertility to 74.9 per cent., but vitamin E, Se and dried brewer's yeast together raised it to 89.6 per cent.

Hatchability of fertile eggs from the group on the unsupplemented diet was 50 per cent. With a single supplement the greatest increase, to 65.8 per cent., was with vitamin E; neither Se nor dried brewer's yeast had any effect. Addition of Se to the vitamin E supplement reduced

hatchability to 62.8 per cent., and vitamin E, Se and dried brewer's yeast together did not significantly increase it over that with vitamin E alone.

For eggs from a group of birds on the vitamin E-deficient diet, whose ancestors had been reared on it for 5 generations, fertility and hatchability were 41.3 and 42.1 per cent., respectively.—J. S. Thomson. (Nutrition Abstracts & Reviews)

DAVIES, R. E., B. L. REID, A. A. KURNICK and J. R. COUCH.
THE EFFECT OF SULFATE ON MOLYBDENUM TOXICITY IN THE CHICK. *J. Nutrition*, 1960, 70, 193-198. (Dept. Biochem., Texas Agric. Exp. Stat., College Station.)—Purified diets containing 500 to 8000 p.p.m. Mo as sodium molybdate depressed growth in chickens. The mortality rate was low with amounts up to 4000 p.p.m.; with 8000 it was 61 per cent. Ammonium molybdate was more toxic than the Na salt. Hb concentration, packed cell volume and red cell count were raised by amonuts of Mo up to 2000 p.p.m., but with 4000 p.p.m. and over anaemia occurred. Addition to the diet of 8000 p.p.m. sulphate as the Na or ammonium salt greatly reduced the growth depression and anaemia induced by 4000 p.p.m. Mo, but the NH_4 ion was somewhat toxic at the level 4500 p.p.m., present in the sulphate. Methionine had no beneficial effect. The greatly increased storage of Mo in the tibiae caused by giving Mo was not reduced by dietary sulphate. Diarrhea did not occur in any of the birds, nor was there any gross physical change except retarded growth.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

DE VUYST, A., A. MOREELS, W. VERVACK, M. VANBELLE and R. ARNOULD. Etude de l'action de l'oleandomycine ajoutee a une ration pour poussins.
THE EFFECT OF OLEANDOMYCIN ADDED TO A RATION FOR CHICKENS. *Agricultura*, 1959, 7, 199-206. Flemish and English summaries. (Centre Recherches Zootech., Univ. Louvain, Louvenjoul.)—From day-old to 10 weeks 150 Nichols White chickens in batteries were fed to appetite on a basal ration with 20.8 per cent. crude protein. Experimental groups got penicillin 4, or oleandomycin 1 or 2 g. per metric ton feed. Those given oleandomycin gained significantly more weight; the difference was seen in the first week when 1 g. was given, but not until the seventh with 2 g. There was no significant difference between groups in feed required per unit weight gained.—T. D. Bell. (Nutrition Abstracts & Reviews)

DI GIORGIO, J., J. J. VITALE, and E. E. HELLERSTEIN. (Dept. of Nutrition, Harvard School of Public Health, and Dept. of Pathology, Harvard Medical School, Boston, Mass.)
MAGNESIUM DEFICIENCY IN DUCKS. *Fed. Proc.* 19(1 Pt. 1) 89: 1960.—Abstract. (Biological Abstracts)

ERASTOV, G. M. Znacenie dobavok zira v racionah brojlerov.
IMPORTANCE OF ADDED FAT IN BROILER RATIONS. *Ptice-vodstvo*, 1960, No. 5, 17-18. (Nutrition Abstracts & Reviews)

FANGAUF, R. and H. VOGT. Getrocknete Brennereiruckstande im Kukenfutter. 2. Trockenschlempe.
DRIED DISTILLER'S RESIDUES IN CHICKEN FEED. 2. DISTILLER'S DRIED GRAINS WITH SOLUBLES. *Arch. Geflugelk.*, 1959, 23, 377-383. (Lehr-Versuchsanst. Kleintierzucht, Kiel-Steenbek.) English summary. For part 1 (not numbered) see Abst. 6290, Vol. 28.—2. Day-old Nichols chicks in groups of 70 were fed to appetite for 8 weeks on a basal diet of ground cereals, groundnut and heated soya bean meals, fishmeal. $CaCO_3$, vitamins, minerals and antibiotics, alone or with 3 per cent. dried yeast, or 2 or 3 per cent. distiller's dried grains and solubles mixed together after drying, or 3 per cent. either grains or solubles alone. The distiller's by-products were derived from potato or cassava.

Weight gains and feed intake and utilisation were about the same with 3 per cent. grains and solubles together, thought to contain an

unknown growth substance, as with the yeast, and these groups were also free from paralysis which was caused by vitamin B deficiency and was most prevalent in the group given the basal diet alone and in those given distilller's dried grains only. There was no differnece between potato and cassava products.

It was concluded that dried grains and solubles given separately were on the whole less effective than a mixture of both.—I. R. Anderson. (Nutrition Abstracts & Reviews)

FANGAUF, R., H. VOGT and W. PENNER. Kukenwuchsprufung mit Oleandomycin.

CHICKEN GROWTH TRIALS WITH OLEANDOMYCIN. *Arch. Geflugelk.*, 1960, 24, 63-66. (Lehr-Versuchsanst. Kleintierzucht, Kiel-Steenbek.) English summary.—Day-old New Hampshire chickens in 5 groups of 90 were given for 8 weeks the same basal all-mash ration with 1, 2 or 4 mg. oleandomycin or 5 mg. penicillin per kg. feed or no supplement. Weight gains were 1.5, 6.6, 8.4 and 1.3 and feed efficiency 3.2, 3.2, 5.5 and 2.7 per cent. better in the groups given antibiotic than in the group getting no supplement. Losses during the trial were 4.4, 4.4, 0, 2.2 and 5.6 per cent., respectively. It is concluded that 2 mg. oleandomycin per kg. feed is adequate.—R. G. Hankin. (Nutrition Abstracts & Reviews)

FEDDE, M. R., P. E. WAIBEL and R. E. BURGER.

FACTORS AFFECTING THE ABSORBABILITY OF CERTAIN DIETARY FATS IN THE CHICK. *J. Nutrition*, 1960, 70, 447-452. (Dept. Poultry Husb., Inst. Agric., Univ. Minnesota, St. Paul.)—In the first experiment groups of 10 male chickens were given a control diet based on maize and soya bean meal, and for experimental groups 20 per cent. fat of different types was incorporated at the expense of those 2 ingredients while maintaining the energy : protein ratio. There was little effect on growth to 4 or 8 weeks, and all the fats improved efficiency of feed utilisation. Apparent absorbability of tallow was low, and excretion of fat in droppings was high when beef tallow was the fat. This was more marked at 4 than at 8 weeks. When 0.5 per cent. ox bile was given with the tallow there was some imrpovement in absorption.

In the next trial experimental groups were given diets with 20 per cent. safflower oil or tallow. One group got the tallow throughout, and other groups were changed from safflower oil, or the basal diet without added fat, to 20 per cent. tallow at 2, 4, 6 or 8 weeks of age. Birds on 20 per cent. tallow excreted more fat than other groups. Apparent absorption increased with age, but at comparable ages there was no difference between birds on tallow throughout and those changed to tallow at later ages.

In a trial in which chickens on a basal diet with 20 per cent. tallow were given ox bile from 0.05 to 8.0 per cent., levels of bile above 0.5 per cent. significantly improved absorption of fat, but higher levels gave no further advantage. Growth was depressed by 4.0 or 8.0 per cent. bile. Gall bladders were bigger when 1.0 per cent. or more bile was given.

Finally diets with 20 per cent. tallow were given with normal, low or high Ca, to appetite, or normal Ca restricted to 60 or 80 per cent. of the amount eaten when given to appetite. Restricted feed reduced growth but did not affect absorption of fat, or efficiency. High Ca depressed growth, efficiency and absorption of fat, and low Ca, with P reduced to maintain a suitable Ca : P ratio, improved absorption of fat.—T. D. Bell. (Nutrition Abstracts & Reviews)

FERGUSON, T. M., R. L. ATKINSON, R. H. MITCHELL, M. L. JONES, and J. R. COUCH. (Texas A and M College System, College Station, Texas.)

B-VITAMIN DEFICIENCY IN THE MATURE TURKEY HEN. *Fed. Proc.* 19(1 Pt. 1) : 414. 1960.—Abstract. (Biological Abstracts)

FERRANDO, R., R. FLORIO, G. THEODOSSIADES, P. COTTEREAU and A. FRADET. Regime supplemente aux antibiotiques et cholesterolemie chez le poulet.

ANTIBIOTIC SUPPLEMENTS TO THE RATION AND BLOOD CHOLESTEROL IN CHICKENS. *Bull. Acad. nat. Med.*, 1960, 144, 160-162 (Lab. Aliment., Ecole Nat. Vet., Alfort.)—In chickens from 2 sources, ready for slaughter at 8 or 9 weeks, blood cholesterol values ranged from 0.90 to 2.62 g. (mg. in text) per 1000 and were unaffected by antibiotics added to the rations to speed up growth.—W. M. Deans. (Nutrition Abstracts & Reviews)

FISHER, H. and **P. GRIMINGER** (with **H. LUTZ**).

THE AMINO ACID REQUIREMENT OF LAYING HENS. 5. AMINO ACID BALANCE IN LOW PROTEIN DIETS. *Poultry Sci.*, 1960, 39, 173-175. (Dept. Poultry Sci., Rutgers Univ., New Brunswick, N.J.) For part 4 see Abst. 6791, Vol. 29.—5. In the present experiments the low-protein diet contained 12 per cent. protein and 0.44 per cent. arginine and it was given to laying hens for 6 months. Compared with a diet with 15 per cent. protein it depressed growth, egg production and egg weight. Addition of 2.5 per cent. gelatine, a good source of arginine, markedly improved performance; 2.5 per cent. zein had no effect and 2.5 per cent. glutamic acid further depressed growth and egg production.

Compared with the diet with 15 per cent. protein, that with 12 per cent. gave poor growth of chickens. Arginine improved growth but not up to the level of that obtained with 15 per cent. protein; zein had no effect and glutamic acid markedly depressed it.

It is concluded that the arginine requirement of the laying hen is greater than 0.44 per cent. of a diet with 12 per cent. protein.—J. S. Thomson. (Nutrition Abstracts & Reviews)

FISHER, H., P. GRIMINGER, G. A. LEVEILLE, and **R. SHAPIRO.** (Rutgers U., New Brunswick, N. J.)

QUANTITATIVE ASPECTS OF LYSINE DEFICIENCY AND AMINO ACID IMBALANCE. *Jour. Nutrition* 71(3): 213-220. 1960.—A series of studies on amino acid imbalance in growing chicks indicated that: (1) The chick is as susceptible as the growing rat. (2) Imbalance was created through the addition of an esesntial amino acid mixture deficient in lysine, which was also limiting in the dietary protein. (3) The imbalance was due to an altered ratio of the limiting amino acid to the total available protein or essential amino acids. (4) The imbalance produced by the addition of the amino acid mixture deficient in lysine was most pronounced when the level of lysine permitted growth above maintenance, but below optimal growth rate. (5) There was reduced consumption of feed, hence of the most limiting amino acid, but no evidence that the limiting amino acid was utilized less well than when no imbalance was created. (6) The amino acid composition of nitrogenous mixtures which will produce an imbalance appears to involve essential amino acids that, as a mixture or in combination with the dietary protein are sufficiently balanced as to permit growth when the single amino acid limitation is overcome. Single amino acid supplements or a mixture of non-essential amino acids produced an imbalance which was not related to the deficiency or limitation of one amino acid. In the case of the non-essential amino acid mixture it was apparently related to the adequacy of all of the essential amino acids in the diet.—Auth. summ. (Biological Abstracts)

GIBSON, W. W. C.

CALCIUM LACTATE AS A DIETARY SUPPLEMENT FOR LAYING HENS. *Vet. Rec.*, 1960, 72, 151. (R. and W. Paul Ltd., Ipswich).—In a diet with 17 per cent, crude protein and 840 Cal. productive energy per lb. of substitution of 1 per cent. calcium lactate pentahydrate for ground oats increased the egg production of battery hens by 4 per cent. over 9 months. The increase was uneconomical as it did not pay for the increased cost of the diet and the increase in feed consumption. See also Absts. 6792, Vol. 29; 5075, Vol. 30.—J. G. Gordon. (Nutrition Abstracts & Reviews)

GIESSLER, H., and **M. KIRCHGESSNER.** (Agric. Coll., Stuttgart-Hohenheim, Germany.) Uber die Wirkung von Cu- und Mn- Zulagen bei der Schweinemast und Kukenaufzucht.

THE EFFECT OF Cu AND Mn SUPPLEMENTS IN SWINE AND POULTRY RAISING. *Landwirtschaftl. Forsch.* 12(3): 159-165. 1959.—When 3 groups of 7 pigs each were raised and finished from 20 kg. to 96 kg. over a period of 110 days and supplemented with either 25 mg Cu or 128 mg Mn per animal per day or no trace element supplement, no statistical differences in dry matter, digestible dry matter, digestible protein, total digestible nutrients consumption and daily weight gains were found. The treatment groups contained 1.6 times the amount of Cu or 2.9 times the amount of Mn of the control group. The control group, however, obtained sufficient amounts of Cu and Mn in the basic ration to obscure differences in treatments. A similar experiment with chickens using sulfates or chlorides of Cu and Mn gave similar results, except for Mn-sulfate, which decreased weight gains.—G. F. W. Haenlein. (Biological Abstracts)

GOBEL, G. Die biologische Wertigkeit verschiedener Futtermischungen nach Versuchen an wachsenden Hahnchen.

BIOLOGICAL VALUE OF DIFFERENT FEED MIXTURES FROM STUDIES ON GROWING COCKERELS. *Arch. Tierernahrung*, 1959, 9, 408-429. (Inst. Tierernahrung, Martin Luther Univ., Halle-Wittenberg.)—Results are reported of N balance experiments on 13 groups of 2 to 6 cockerels of about 1100 g., 42 in all, supplied with protein from fishmeal, extracted soya grits, or coarsely ground field beans; or a 25 : 75, 50 : 50 or 75 : 25 mixture of fishmeal with each vegetable protein; or similar mixtures of the 2 vegetable proteins; or a mixture of equal parts of fishmeal, soya grits and field beans. The amounts of protein given were intended to supply 3 times the N required for maintenance suggested by Wetterau *(Kuhn-Archiv*, 1954, 68, 202) but when fishmeal alone was used the birds refused to take more than about twice that amount. Experimental methods were those of Wetterau. Results are given in tables.

Mean biological values according to the method of Thomas and Mitchell were: fishmeal 71.8, soya grits 56.6, field beans 61.3; fishmeal and soya grits 25 : 75, 50 : 50, 75 : 25, respectively, 58.7, 54.3, 63.1; fishmeal and field beans in the same proportions, 55.4, 64.1, 74.6; soya grits and field beans in the same proportions, 51.9, 70.0, 65.2; fishmeal, soya grits and field beans 67.5. The mean physiological values, based on true digestibility and biological values, for the protein feeds in the same order were 65.2, 50.2, 56.1; 51.6, 48.4, 53.9; 47.9, 57.2, 66.5; 44.2, 54.0, 61.1; 59.1. In biological value fishmeal was significantly better than field beans and soya grits; the 75 : 25 mixture of fishmeal and soya grits was significantly better than the 50 : 50 mixture; and the mixture of all 3 was significantly better than field beans alone, or the 50 : 50 mixture of fishmeal and soya grits, the 25 : 75 and 75 : 25 mixtures of fishmeal and field beans, and the 25 : 75 and 50 : 50 mixtures of soya grits and field beans. Linear regression equations are given for the biological and physiological values of mixtures of fishmeal and field beans and of soya grits and field beans. For mixtures of fishmeal and soya grits the relation was not linear.

Experimental results are compared with those calculated by methods of other workers.—W. M. Deans. (Nutrition Abstracts Reviews)

GRAY, J. A., E. M. OLSEN, D. C. HILL and **H. D. BRANION.**

EFFECT OF A DIETARY LYSINE DEFICIENCY ON THE CONCENTRATION OF AMINO ACIDS IN THE DEPROTEINIZED BLOOD PLASMA OF CHICKS. *Canad. J. Biochem. Physiol.*, 1960, 38, 435-441. (Dept. Nutrit., Ontario Agric. Coll., Guelph.)—A lysine-deficient diet was based on ground wheat, with vitamin and mineral supplements and expeller sunflower seed meal as source of protein, providing 24 per cent. crude protein and 0.65 per cent. lysine in the diet. A lysine-adequate diet contained 0.5 per cent. lysine in addition. Groups of 25 cockerels were fed on each diet for 4 weeks. One group

on each diet was fed and the others were starved for 24 hr. before blood samples were taken. In a second experiment 4 groups of 20 birds were given each diet; 1 group was fed and the others were starved for 24 hr. before samples were taken.

The effect of the deficient diet was to decrease the lysine content of plasma, which fell from 4.6 to 1.0 and from 4.1 to 1.2 mg. per 100 ml. in the 2 trials. The lysine content in birds starved 24 hr. was higher but still less in birds on the deficient diet than in those given extra lysine.

Low lysine intake increased plasma threonine, from 6.1 to 15.5 and from 6.6 to 16.4 mg. per cent., and tyrosine, from 2.4 to 3.8 and from 2.5 to 4.1 mg. per cent. Fasting produced higher threonine levels on both diets, and lower tyrosine levels especially in the plasma of birds on the deficient diet. Birds fed on adequate diet for 3 days after 25 days on deficient diet had normal plasma amino acid levels. Birds given the deficient diet for 3 days after 25 days on adequate diet had plasma amino acid levels similar to those of birds given the deficient diet throughout.—M. M. Barnes. (Nutrition Abstracts & Reviews)

GREENE, D. E., H. M. SCOTT and H. W. NORTON.

FACTORS AFFECTING THE RESPONSE TO FLUID EGG YOLK. *Poultry Sci.*, 1960, 39, 7-12. (Illinois Agric. Exp. Stat., Urbana.)—In trials lasting 21 days, with chickens 1 week old at the start there were 2 basal diets: a semi-synthetic diet containing glucose with casein, soya bean oilmeal and gelatine supplying 35.5 per cent. protein and previously shown to support excellent growth (see Abst. 3128, Vol. 28) and a diet containing sucrose, soya bean oilmeal and zein, protein content 22.15 per cent. To each additions were made of 20 per cent. fluid egg yolk, or of 6.5 per cent. egg oil or 4.1 per cent. dried egg white or both, representing the fat and protein contents equivalent to the egg yolk; the additions were made at the expense of glucose or sucrose on a basis of equivalent energy.

The effect on growth of adding egg yolk or egg oil was highly significant with both diets, greater on the second, but the difference in effect between the supplements was significant only with the second ration. The addition of egg white to the first basal diet had only a slight effect on growth, but on the other diet it had a highly significant effect. When a combination of egg oil and egg white was added to the first basal diet there was no additive effect and growth response was similar to that of egg yolk. When the second basal diet was supplemented with the combination an additive effect was seen. Chickens receiving egg yolk gained slightly faster than those receiving the combination of egg oil and egg white but the difference was not significant when the egg oil was substituted on an equal energy basis. When egg oil was substituted on a weight basis the response to 20 per cent. egg yolk was highly significant as compared with that of a combination of egg oil and egg white.

It is concluded that any effect of adding egg yolk to a ration will depend on the growth-promoting effect of the basal ration and that any improvement in growth will arise from a better balance in the known constituents rather than from the presence of unknown factors.—J. S. Thomson. (Nutrition Abstracts & Reviews)

GRIMINGER, P. and O. DONIS.

POTENCY OF VITAMIN K_1 AND TWO ANALOGUES IN COUNTERACTING THE EFFECTS OF DICUMAROL AND SULFAQUINOXALINE IN THE CHICK. *J. Nutrition*, 1960, 70, 361-368. (Dept. Poultry Sci., Rutgers Univ., New Brunswick, N.J.)—Chicks were given a basal diet low in vitamin K activity supplemented, per kg., with 0.15 to 2.4 mg. vitamin K_1, or equimolecular amounts of menadione or menadione sodium bisulphite complex (MSBC). At 3 weeks of age, plasma prothrombin time was estimated by Quick's method ("Hemorrhagic Diseases", Lea and Febiger, Philadelphia, 1959). Vitamin K_1 was about 1.5 times as active, on an equimolecular basis, in reducing plasma prothrombin time to normal, as was MSBC, and 2.5 times as active as menadione. The requirement of the chick for maintenance of optimum

plasma prothrombin, expressed as mg. per kg. feed, was 1, 1.15 and 1.45, respectively, for vitamin K_1 menadione and MSBC. When the basal diet contained, per kg., 400 mg. dicoumarol, the chick's vitamin K_1 requirement rose to 1600 mg. The menadione compounds, even in large amounts, failed to counteract the effect of dicoumarol. When the basal diet contained 0.2 per cent. sulphaquinoxaline, 4 mg. vitamin K_1 per kg. diet largely counteracted the action of the drug. The menadione compounds were effective also.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

HALLORAN, H. R. and **G. C. CAVANAGH.**

EGG TESTED COTTONSEED MEAL. *Poultry Sci.*, 1960, 39, 18-25. (Halloran Res. Farm, Modesto, Calif.)—Available gossypol units (AGU) were estimated by the combined biological and chemical method of Grau *et al.* (Abst. 1782, Vol. 25) in 45 samples of cottonseed meal from California. Values ranged from 0.23 to 0.67, indicating that it is posible to manufacture cottonseed meals having AGU values of 0.3 or less, the maximum value to avoid objectionable discolouration of the yolk after storage of the eggs at 33° F.

Two samples of cottonseed meal, AGU values 0.27 and 0.33, were given as 10 per cent. of the diet to groups of laying pullets for 11 days, a control group having a ration without cottonseed meal. When the eggs were stored at 33° F. for 3 months, 3 per cent. of the eggs from the control group had a colour score of 3 (dark yellow yolk but not objectionable) compared with 9 and 17 per cent. for the 2 groups given cottonseed meal; at 50° F. storage temperature the figures were 12, 3 and 6 per cent., respectively. At a still higher storage temperature, 70° F., 26 and 30 per cent. of the eggs from the cottonseed meal group had a colour score of 3, indicating an effect of temperature. None of the yolks had a colour score of 4 (objectionable). After storage of eggs for 6 months at a temperature of 50° F. only a small percentage of the eggs from the groups given cottonseed meal showed an objectionable colouration in the yolk and these were from ranches with poor management conditions.—J. S. Thomson. (Nutrition Abstracts & Reviews)

HINNERS, S. W. and **H. M. SCOTT.**

A BIOASSAY FOR DETERMINING THE NUTRITIONAL ADEQUACY OF PROTEIN SUPPLEMENTS FOR CHICK GROWTH. *Poultry Sci.*, 1960, 39, 176-183. (Dept. Animal Sci., Univ. Illinois, Urbana.)—A laboratory-prepared egg-white protein, supplemented with its limiting amino acids, arginine and glycine, and incorporated in a non-protein purified diet was used as a reference standard. That diet gave better growth with chicks than reference casein or Drackett protein, each suitably supplemented with limiting amino acids, at all levels of protein up to 40 per cent. In a comparison with fishmeals in diets with 10 and 15 per cent. protein the sensitivity of the assay was highest with 10 per cent. protein. Equalised or pair-feeding had no advantage over feeding to appetite. Although ratios of weight gain to feed consumption or weight gain per g. protein consumed gave higher variance ratios, gain in weight with feeding to appetite gave an adequate criterion of protein quality. Striking differences in the nutritional value of different samples of fishmeal were noted.

It is concluded that an assay wtih 3 replications of 6 chicks on each treatment at a protein level of 10 per cent. for an experimental period of 13 days, preceded by a pre-experimental period of 14 days on a maize and soya bean meal diet, will give an adequate indication of the relative nutritional value of fishmeals.—J. S. Thomson. (Nutrition Abstracts & Reviews)

HOHLS, H. W. Der Bewertungsmassstab bei Mastprufungen an wachsendem Geflugel.

THE EVALUATION CRITERION IN FATTENING TRIALS WITH GROWING POULTRY. *Celler Jahrbuch*, 1958, 7, 153-169. English summary. (Nutrition Abstracts & Reviews)

HOHLS, H. W. Der Einfluss des Kalorieneiweissverhaltnisses auf die Rohverwertung bei wachsenden Huhnern.

INFLUENCE OF THE CALORIE TO PROTEIN RATIO ON FEED EFFICIENCY OF GROWING CHICKENS. *Celler Jahrbuch*, 1958, 7, 170-187. English summary. (Nutrition Abstracts & Reviews

HOHLS, H. W. Mastversuche mit Fettzugaben bei Leghorn und Nichols-9/108.

FATTENING STUDIES WITH FAT SUPPLEMENTS FOR LEGHORNS AND NICHOLS 9/108. *Arch. Geflugelk.*, 1960, 24, 103-124. (Bundesforschungsanst. Kleintierzucht, Celle.) English summary.—For chickens fattened from hatching to 12 weeks of age fat added to rations with low protein content depressed weight gains, but when there was ample protein weight gains were improved by added fat at 10 per cent. Feed utilisation was more improved by fat with high than with low protein contents. The greater weight gains with added fat were not profitable because of the cost of increasing the protein content.—D. Duncan. (Nutrition Abstracts & Reviews)

HORLICK, L. and **J. B. O'NEIL.**

EFFECT OF MODIFIED EGG-YOLK FATS ON BLOOD-CHOLESTEROL LEVELS. *Lancet*, 1960, i, 438. (Dept. Med., Univ. Saskatchewan, Saskatoon.)—In healthy young adults given a low-fat diet serum cholesterol values fell. When the diet was supplemented with egg yolks the cholesterol values rose, whether the eggs were normal or were from hens given sunflower seed oil and had a sixfold increase in their content of di- and tri-unsaturated fatty acids.—F. C. Aitken. (Nutrition Abstracts & Reviews)

JENKINS, N. K. and **C. TYLER.**

A CRITICAL STUDY OF THE FAILURE OF A LONG-TERM CALCIUM AND PHOSPHORUS BALANCE EXPERIMENT WITH LAYING HENS. *J. Agric. Sci.*, 1960, 54, 131-139. (Dept. Physiol. Chem., Univ. Reading.)—Of 18 pullets about 6 months old 2 were killed at the start of the experiment and the rest were divided into 4 groups of 4. One bird from each group was killed after 26 weeks and another after a year, when the experiment ended. There were 26 collection periods of 14 days. The 4 groups received a basal ration of, per cent., maizemeal 40, barleymeal 23, middlings 10, bran 10, groundnut cake 9, dried skimmed milk 6 and dried yeast 2, and cod liver oil was given daily. Calcium carbonate was added alone or with sodium phosphate so that there were 2 Ca intakes, 2.256 and 4.512 g. daily, each with 2 P intakes, 0.752 and 1.504 g., and Ca : P ratios from 1.5 to 6. The birds were fed once daily and precautions were taken to reduce loss of food. Feathers and eggs were collected as well as droppings. The analytical methods are fully described.

Almost all the hens remained in good health, although 2 died from causes not apparently related to the experiment. Egg production was average to good on all diets and the eggs and shells were of normal composition. There was no major effect of diet on composition of skeleton or of soft tissues. The cumulative Ca and P balances over the year "are such as to make nonsense of the whole experiment". Further study of methods showed that there was no major error in Ca estimation and that the method for P was even more reliable. In general it appeared that only mechanical losses were likely to give rise to a systematic error large enough to account for the impossible balance values. They might have arisen from spilling of food or failure to collect all droppings, and devices which might prevent them are briefly discussed.—D. Duncan. (Nutrition Abstracts & Reviews)

JUVET, M. Mastversuche mit dem Beruhigungsmittel "Sermix".

FATTENING TRIALS WITH THE TRANQUILLISER "SERMIX". *Arch. Geflugelk.*, 1960, 24, 133-136. English summary.—Four trials were made, each with 2 groups of chickens 7 to 9 weeks old, during final fattening in batteries for 18 to 26 days. In each test the chickens had a standard broiler ration alone or with 1 kg. Sermix, providing 2 g.

reserpine, per tonne. In the third and fourth trials some or all of the birds were chemically caponised by implantation of hexoesterol tablets.

In 3 of the 4 trials the Sermix supplement gave better weight gains and feed utilisation than the standard ration. The carcase quality was not improved; in 3 trials the groups given Sermix had a lower percentage of carcases classed 1a.—D. Duncan. (Nutrition Abstracts & Reviews

KENNARD, D. C. and V. D. CHAMBERLIN.

INSOLUBLE GRIT FOR CHICKENS. *Ohio Agric. Exp. Stat. Res. Bull.* No. 848, December 1959, pp.46—In 16 experiments with chickens fed to appetite to 8 or 12 weeks of age and with feed coarsely ground in 11 and finely ground in 5, granite grit, 5 per cent. added to the ration, had no significant effect on growth. On the coarsely ground feed efficiency was slightly better without grit.

In 8 experiments with chickens grown from 6 or 8 weeks to 18 weeks of age, given finely ground feed or coarse feed including whole maize and oats, there was again no difference over all in growth or efficiency attributable to granite grit included in the ration at the same rate.

Gizzards of 288 birds before and after laying were studied. The birds had been fed on fine or coarse feed, each with or without grit. Both texture of the feed and granite affected the gizzard. Grits with finely ground feed, or coarse feed with or without grit gave heavier gizzards than fine feed without grit. The gizzard lining was affected also, in a similar way. There was more fatty tissue surrounding the lighter gizzards.

In the first laying trial, with 4 groups of 50 pullets given coarse feed, the groups had free access to oyster shell grit without or with silica or granite grits, or to granite grit only. Either of the insoluble grits given with oyster shell improved egg production and efficiency. When oyster shell was not available egg production was poor, many soft-shelled or shell-less eggs were laid, efficiency was low and the birds ate granite grit amounting to 26 per cent. of the weight of feed. In other trials it was found that on coarse feed egg production and efficiency were better when granite grit was available, but that was not so on the same feed when finely ground. When silica or granite grits were offered as the insoluble grits, intake of silica was less, but production and efficiency were better.—T. D. Bell. (Nutrition Abstracts & Reviews)

KIMURA, S. and H. ARIYAMA.

ON THE NUTRITIVE STUDIES OF PANTOTHENIC ACID BY ANTIMETABOLITES. 1. PANTOTHENIC ACID DEFICIENCY PRODUCED BY *w*-METHYL PANTOTHENIC ACID IN MICE. 2. EFFECT OF *w*-METHYL PANTOTHENIC ACID ON THE DEVELOPMENT OF THE CHICK EMBRYO. *Tohoku J. Agric. Res.*, 1959, 10, 129-135; 237-240. (Dept. Living Sci., Fac. Agric., Tohoku Univ., Sendai.)

1. Male weanling mice were given a basal diet devoid of pantothenic acid and supplemented with sodium *w*-methylpantothenate and calcium pantothenate in different amounts and proportions for 16 days, after which they had the basal diet alone. Depression of weight gain increased with the amount of *w*-methylpantothenic acid given, but the effect depended more on the ratio of *w*-methylpantothenic acid to pantothenic acid than on the absolute amounts of the antagonist (which are not clearly stated). The interference ratio (Drell and Dunn, Abst. 3456, Vol. 21) appeared to be between about 100 : 1 and 60 : 1. The effects of the larger amounts of the antagonist were not reversed by return to the basal diet; some mice died and the alopecia on the heads of survivors extended to cover almost the entire body. They were then given a diet with pantothenic acid 3 mg. and inositol 100 mg. per 100 g. diet; after 10 days the hair began to grow and in 2 weeks they had almost recovered. It is suggested that *w*-methylpantothenic acid may act by blocking synthesis of coenzyme A.

2. Solutions containing from 0.05 to 30.0 mg. *w*-methylpantothenic acid in 0.1 ml. water were injected into the yolk sac of eggs from White Leghorn hens on the second day of incubation at 38° C. Injection of

more than 10 mg. caused death of all the embryos, in four-fifths of them during the first week, but when 10 mg. was injected into 8-day-old embryos almost all survived. The toxic effect of 10 mg. *w*-methylpantothenic acid was prevented by simultaneous injection of 0.05 mg. or more of pantothenic acid, that is, the interference ratio was about 200 : 1. It was previously found (unpublished work) that chickens surviving after injection of *w*-methylpantothenic acid had a reduced content of coenzyme A in their livers and that *w*-methylpantethine inhibited acetylation of sulphanilamide, but *w*-methylpantothenic acid did not. It is suggested that synthesis of *w*-methylpantetheine from *w*-methyl-pantothenic acid *in vivo* may explain the action of *w*-methylpantothenic acid.—A. Crossland. (Nutrition Abstracts & Reviews)

KLAIN, G. J., D. E. GREENE, H. M. SCOTT, and **B. CONNOR JOHNSON.** (U. Illinois, Urbana.)

THE PROTEIN REQUIREMENT OF THE GROWING CHICK DETERMINED WITH AMINO ACID MIXTURES. *Jour. Nutrition* 71(3):209-212. 1960.—The N requirement of chicks was determined using crystalline amino acid diets. For optimum efficiency of feed utilization the requirement was approximately 4.0% N. It was observed, however, that a lower N level (3.2%) resulted in equally good growth and N retention, but lower feed utilization. Chicks were able to gain satisfactorily on this low N diet by voluntarily eating more of the ration. This has the effect of increasing the absolute intake of dietary amino acids.—Auth. summ.

KLAIN, G. J., D. C. HILL, J. A. GRAY and **E. M. OLSEN.**

OBSERVATIONS ON THE INFLUENCE OF DIETARY PROTEIN LEVEL AND AMINO ACID BALANCE ON PIGMENTATION IN THE FEATHERS OF CHICKS. *Poultry Sci.*, 1960, 39, 25-29. (Dept. Nutrit., Ontario Agric. Coll., Guelph.)—The diet given to Barred Plymouth cockerels to 4 weeks of age was a semi-purified one containing, as sole source of lysine, soya bean oilmeal supplemented with methionine. Protein was gradually reduced from 21.4 to 8 per cent.. lysine being thereby reduced from 1.2 to 0.47 per cent. None of the groups showed achromatosis but a group receiving a sunflower seed oilmeal containing 24.6 per cent. protein and 0.65 per cent. lysine showed severe achromatosis, indicating that a low level of lysine as such was not the cause.

In an attempt to produce achromatosis on the soya bean meal diet with 8 per cent. protein and 0.47 per cent. lysine different supplements were added. Zein 15 per cent., supplying only 0.014 per cent. lysine, caused severe achromatosis which was alleviated by the further addition of 0.6 per cent lysine. Wheat gluten, 15 per cent., supplying 0.21 per cent. lysine, produced moderate achromatosis which was prevented by the further addition of 0.4 per cent. lysine. Addition of mixtures of 5 or 4 different amino acids, excluding lysine, did not induce achromatosis.

With a diet containing 21.7 per cent. protein and 1.2 per cent. lysine, an increase in protein up to over 60 per cent. by the use of soya bean protein or zein, the lysine increasing to 4.1 per cent., did not produce achromatosis. Rate of growth of the birds was not a factor.

It is concluded that achromatosis occurs only when the ration is low in lysine and high in other amino acids.

For earlier work see Abst. 5951, Vol. 27.—J. S. Thomson. (Nutrition Abstracts & Reviews)

KLAIN, G. J., H. M. SCOTT and **B. C. JOHNSON.**

THE AMINO ACID REQUIREMENT OF THE GROWING CHICK FED A CRYSTALLINE AMINO ACID DIET. *Poultry Sci.*, 1960, 39, 39-44. (Illinois Agric. Exp. Stat., Urbana.)—The diet used, given to appetite, contained maize starch, maize oil, cellulose, minerals and vitamins and 30 per cent. of a mixture of essential amino acids present in amounts simulating those found in fat-free chicken tissue (see Price *et al.*, Abst. 2049, Vol. 24). Starting with this mixture graded amounts of each of the amino acids were given to male chickens 7 days old for

5 to 7 days to establish the best level for growth and efficiency of feed utilisation. When a level giving maximum response for a particular amino acid was established from regression equations it was incorporated into the amino acid mixture and used for subsequent tests.

The calculated essential amino acid requirements, as per cent. of the diet, were: L-lysine 1.01, L-tryptophan 0.17, L-threonine 0.58, L-leucine 1.68, L-histidine 0.41, DL-methionine (in absence of L-cystine) 0.47 DL-methionine (in presence of 0.4 per cent. L-cystine) 0.18 L-phenylalanine 0.59, L-tyrosine 0.71, L-*iso*leucine 0.73, L-valine 0.83, L-arginine 1.08, L-glutamic acid 15.77. The requirement for glycine was not established; the first test showed a requirement of less than 0.5 per cent. while a second test showed that glycine was not essential. With this type of diet given to appetite, a growth rate of about 9 g. per day could be obtained.—J. S. Thomson. (Nutrition Abstracts & Reviews)

KOBAYASHI, HIDESHI. (Tokyo U., Japan.), **AUBREY GORBMAN.**
RADIOIODINE UTILIZATION IN THE CHICK. Endocrinology 66(6):795-804. 1960.—The effects of thyrotrophin, thiouracil and diets containing various amounts of iodine upon thyroidal metabolism of radioiodine were studied in chicks. Great variability of quantity of radioiodine accumulated by the chick thyroid at different seasons was redemonstrated. The level of additional administered iodine did not appreciably affect this variability. TSH increased the absolute thyroid uptake of I^{131}; additionally administered iodine and thiouracil depressed it. Labeled monoiodotyrosine, diiodotyrosine, triiodothyronine, and thyroxine were found in normal chicks. Their proportions were altered by the various experimental conditions and by season alone. Thyrotrophin favored thyroxine production. Thiouracil appeared to block hormone synthesis at the monoiodotyrosine stage. With time, MIT/DIT ratios of more than seven were progressively developed, indicating accumulation of MIT in thiouracilized thyroids. Some of the factors in the well known seasonal variability of thyroid function in chicks are discussed.—Auth. abst. (Biological Abstracts)

KOCI, E. Vyskum vhodnych druhov krmiv a ich vzajomneho pomeru pre kurcata a nosnice na zaklade vol'neho vyberu krmiv.
CHICKEN AND LAYER FEEDS AND FREELY CHOSEN DIETS. *Pol'nohospodarstvo*, 1959, 6, 881-896. (Res. Inst. Animal Prod. CSAZV, Viglas.) English, German and Russian summaries.—Hens in the first year of the laying period were divided into 2 groups of 75. One group was given free choice of the ingredients of the diet and the other a complete mixture and grain. Daily feed consumption was recorded. There was no significant difference in egg production or feed consumption between the groups.—A. Jancarik (Czechoslovakia). (Nutrition Abstracts & Reviews)

KOWALEWSKI, K.
EFFECT OF BETA-AMINOPROPIONITRILE AND CHOLESTEROL ON LIPIDS AND AORTIC S^{35} SULPHATED MUCOPOLYSACCHARIDES IN COCKERELS. *Proc. Soc. Exp. Biol. Med.*, 1960, 103, 433-435. (McEachern Cancer Res. Lab., Univ. Alberta, Edmonton.) From age 16 days chickens received in their commercial diet no supplement, or 0.025 per cent. β-aminopropionitrile (BAPN), or BAPN with cholesterol 2 and olive oil 5 per cent., or the cholesterol and oil alone. After 4 weeks the birds were killed, but 24 hr. before that they received by subcutaneous injection sodium sulphate labelled with ^{35}S at 1 mC. per kg. bodyweight.

All the birds (all those given BAPN?) showed hock deformities and crooked toes of different degree. About 16 per cent. of those given BAPN alone or with cholesterol died of aortic rupture. BAPN did not much affect the distribution of lipids produced by cholesterol and it did not influence the uptake of ^{35}S by aorta or bone. Cholesterol did increase uptake of ^{35}S by sulphated polysaccharides of the aorta, but not that by bone.—D. Duncan. (Nutrition Abstracts & Reviews)

LAKSESVELA, B.
SUPPLEMENTATION OF CHICK DIETS WITH VITAMIN E TO IMPROVE MEAT QUALITY. *J. Sci. Food Agric.*, 1960, 11, 128-133. (Herring Oil and Meal Indust. Res. Inst. (S.S.F.), Straumsgrend, Norway.)—The taste and odour of grilled meat from freshly killed chickens, 1.2 kg. in weight, reared on diets containing 6 or 15 per cent. herring meal of good quality or rich in unsaturated fats, was significantly improved by supplements of D-α-tocopheryl acetate, 36.7 mg. per kg. diet. In a single test, addition of vitamin E to an all-vegetable diet improved the palatability of the meat. With diets containing 15 per cent. of either type of herring meal, massive doses of the vitamin, 125 mg. per bird, during the first week of life or the 5 days before slaughter, improved the flavour of the meat, though not as much as smaller amounts over a longer period. Growth rate and efficiency of feed conversion were improved by adding 36.7 mg. tocopheryl acetate per kg. to normal diets; when the diet contained 36 per cent. wheat offal, little effect was found.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

LANDAU, L., V. PETER and A. SPRONC. Pastevny vykrm moriek a jeho ekonomika v porovnani s vykrmom na obmedzenom vybehu.
GRAZING AND CHICKEN-YARD TURKEY BROILERS. *Pol'nohospodarstvo*, 1959, 6, 843-866. (Poultry Res. Inst. SAV, Ivanka pri Dunaji.) English, German and Russian summaries.—Up to the 55th day of life 208 Bronze turkeys were fed on a commercial chicken ration with 20 per cent. crude protein supplemented with 2 per cent. train oil and green forage to appetite. From the 55th day 113 birds were kept in a mobile henhouse with free access to grazing up to the 186th day of life and 95 birds were kept in a restricted area of 120 sq. m. with a simple roofed shelter.

Both groups of turkeys were given the commercial chicken ration to appetite. Average weight gains over the whole period were 5205.6 and 4987.0 g. From 151 to 185 days the daily weight gain in the group of turkeys in henhouses was 38.5 g. compared with 19.0 g. in the simple shelters; that accounted for the difference in final liveweight. The experimental group ate less feed. Health and carcase value of birds were similar in the 2 groups.—M. Proksova (Czechoslovakia). (Nutrition Abstracts & Reviews)

LANDAU, L., V. PETER and A. SPRONC. Dokrm moriek kukuricnym srotom vol'nym sypanim s pridavkom a bez pridavku zeleneho krmiva.
MAIZEMEAL WITH AND WITHOUT GREEN FEED AS TURKEY BROILER DIET. *Pol'nohospodarstvo*, 1959, 6, 897-912. (Poultry Res. Inst. CSAZV, Ivanka pri Dunaji.) English and Russian summaries. There were 4 groups of 12 turkeys. Two groups were reared on a bare run and given maizemeal with or without green feed and 2 groups were given maize with or without green feed and grazed freely. The experiment lasted 3 weeks. The turkeys gained weight only during the first 2 weeks. During the third week all groups lost weight. Average daily gains over the whole period were from 11.8 to 21.1 g. Gains of birds with access to grazing were significantly greater than those on bare runs.—A. Jancarik (Czechoslovakia). (Nutrition Abstracts & Reviews)

LEVEILLE, GILBERT A.
THE AMINO REQUIREMENTS FOR MAINTENANCE IN THE ADULT ROOSTER. Dissertation Absts. 20(11):4261-4262. 1960.—Abstract (Biological Abstracts)

LEVEILLE, G. A. and H. FISHER.
AMINO ACID REQUIREMENT FOR MAINTENANCE IN THE ADULT ROOSTER. 3. THE REQUIREMENTS FOR LEUCINE, ISOLEUCINE, VALINE AND THREONINE, WITH REFERENCE ALSO TO THE UTILIZATION OF THE D-ISOMERS OF VALINE, THREONINE AND ISOLEUCINE. *J. Nutrition*, 1960, 70, 135-140. (Dept. Poultry Sci., Rutgers Univ., New Brunswick, N.J.) For part 2 see Abst. 5055, Vol. 30.—3. The method was that used before. The maintenance requirements, in mg. per kg. body-weight per day, for

adult cockerels were L-leucine 124, L-*iso*leucine 72, L-threonine 74 and L- or DL-valine 61. Corresponding minimum levels for maintenance of N equilibrium were 54, 49, 55 and 55 mg. per kg. per day. The D- isomers of threonine and *iso*leucine appeared to be unavailable but D-valine was as good as L-valine.—D. Duncan. (Nutrition Abstracts & Reviews)

LOBIN, N. V. Kormlenie mjasnyh cypljat.
FEEDING TABLE CHICKENS. *Pticevodstvo*, 1960, No. 5, 11-16. (Nutrition Abstracts & Reviews)

MacINTYRE, T. M. and **J. R. AITKEN.**
THE PROTEIN REQUIREMENTS OF LAYING HENS IN FLOOR PENS AND INDIVIDUAL CAGES. *Canad. J. Animal Sci.*, 1959, 39, 176-181. (Canada Dept. Agric., Res. Branch, Nappan, N.S.)—Pullets housed in floor pens or in battery cages were given diets supplying 825 Cal. productive energy per lb. and protein from 10.9 to 16.7 per cent. About 13 per cent. crude protein was sufficient for egg production but not for maintenance of egg size and bodyweight. The amount of protein in the diet did not affect the quality of egg albumin or the incidence of meat and blood spots. The environment did not affect protein requirement. Caged birds laid fewer and heavier eggs than birds on the same diet in floor pens and consumed less feed.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

MacINTYRE, T. M. and **J. R. AITKEN.**
THE PERFORMANCE OF LAYING HENS REARED ON RESTRICTED AND FULL FEEDING PROGRAMS. *Canad. J. Animal Sci.*, 1959, 39, 217-225. (Canada Dept. Agric., Nappan, N.S.)—Experiments were made in 3 successive years to find the effect of restricting feed intake to 63 to 76 per cent. of full feed during the period between putting the pullets on range and attainment of sexual maturity, when they were moved to laying houses. During laying, the diet was not restricted. Birds on restricted intake came into production later and then laid more intensively than those on full feed. In 2 experiments total egg production was not affected by restriction; in a third, where restriction was severe, production was significantly higher in the full-fed birds. Restricted birds were more efficient; they ate 0.17 lb. less feed per dozen eggs than control birds, or 3 lb. less feed per head. Restriction increased egg size significantly during the first few weeks of production. Bodyweight was appreciably lower at maturity than in control birds but not significantly lower at the end of the laying year. Mortality was not affected.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

MILLER, EDWARD C., JEAN S. O'BARR, and **CHARLES S. DENTON.**
(U. S. Dept. of Agriculture, Animal Husbandry Research Division.)
STUDIES ON A SHORT TERM PROCEDURE FOR DETERMINING AMINO ACID REQUIREMENTS OF LAYING HENS. *Fed. Proc.*, 19(1 Pt. 1): 12. 1960.—Abstract. (Biological Abstracts)

MOSTERT, C. G.
HENS MUST RECEIVE CORRECT AMOUNT OF CALCIUM. *Farming in S. Africa*, 1960, 36, No. 1, 13.—In trials in 2 years it was found that hens in batteries required from 2.5 to 3.5 per cent. Ca in all-mash diets for optimum egg shell quality. If oyster shell grit was available to the birds Ca in the mash could be reduced to 1.5 per cent. —T. D. Bell. (Nutrition Abstracts & Reviews)

MULLER, Z. and **V. LAUTNER** 1960. (Antibiotic Research Institute and Control Agricultural Institute, Prague, Czechoslovakia) Vliv prikrmovani antibiotiky na obsah axerophtolu, karotenu, tokoferolu a kobaliminu v organismu a v zivocisnych produktech drubeze. (Summary in English and Russian)
THE INFLUENCE OF FEEDING ANTIBIOTICS ON THE CONTENT OF AXEROPTHOL, CAROTENE, TOCOPHEROLS AND

COBALAMINES IN THE ORGANISM AND ANIMAL POULTRY PRODUCTS. *Sbornik CSAZV, zivocisna vyroba* 5, 6: 461-474.—Experimental feeding of hens with antibiotics (5-10 mg per kg of feed) increased the content of vitamins in the blood, liver and, in some cases, the meat. Penicillin has been more efficient than chlortetracycline. No increase was obtained beyond 100 mg. Technical grade chlortetracycline caused an increase in vitamin B_{12} at the higher doses. It is supposed that penicillin favorably influences the conversion of carotene to vitamin A.—V. Orel.

MULLER, Z., V. OREL. 1960. (Antibiotic Research Institue, Prague, Czechoslovakia) Vysledky pokusneho vykrmu kurat ruznych plemen.

EXPERIMENTAL FEEDING OF CHICKENS OF DIFFERENT BREEDS. Sbornik Csagv- zivocisna vyroba, 5, 6:441-448. Summary in Germain and Russian.—Experimental feeding of the chickens in hot summer months at the temperature of nearly 30° C. The feeding rations contained 21 per cent. and 25.7 per cent. of crude protein and the chickens of all breeds has been divided in two groups. After 12 weeks the weight of White Leghorn chickens has been 847 g in one group and 862 g in the second group. The weight of Rhode Island chickens has been 1056 g and 1018 g, the weight of New Hampshires has been 1151 and 1192 g and the highest weight has been in Nichols Lohmann chickens 1378 g and 1508 g. Feed conversion of Nichols Lohmann chickens has been 3.2 kg of feed and of the other breed 4.3 kg and up to 6.6 kg.—V. Orel.

MULLER, Z., J. ROEDL, Z. ZENISEK, V. LAUTNER. 1960. (Antibiotic Research Institue and Central Control Agricultural Institute, Prague, Czechoslovakia)

THE INFLUENCE OF PENICILLIN ON THE EGG PRODUCTION OF TURKEY HENS WITH REGARD TO THE CONTENT OF THE MOST IMPORTANT AMINO ACIDS AND VITAMINS IN EGGS FOR INCUBATION. (Summary in English and Russian). Sbornik CSAZV-zivocisna vyroba 5, 6:427-440.—Experimental feeding of turkey hens with N, N-dibenzylethylendiamine dipenicllin (9 mg per 1 kg of dry matter of feed). The egg production of experimental hens has been 10 eggs higher whereas the egg weight has been nearly 2 g. lower. In eggs or experimental hens an increase of vitamins (beta-carotene, axerophtol, tocopherol has been found.—V. Orel.

O'DELL, B. L. and J. E. SAVAGE.

EFFECT OF PHYTIC ACID ON ZINC AVAILABILITY. *Proc. Soc. Exp. Biol. Med.*, 1960, 103, 304-306. (Dept. of Agric. Chem., Univ. Missouri, Columbia.)—Groups of 10 male chickens were given diets formed by modifying a diet based on casein and gelatine and containing no phytic acid and a soya bean protein with 0.12 per cent. phytic acid P. Modifications included adding Zn, casein-phytic acid complex or calcium phytate to the casein diet and Zn or soya bean protein-phytic acid complex to the soya bean diet.

Zn in isolated soya bean protein was less available than that in casein. Zinc in the casein-phytic acid complex, which contained an amount of phytic acid comparable to that found in soya bean protein alone, was also less available than that in untreated casein. Calcium phytate added to the casein diet had little or no effect on availability of Zn.—G. F. Garton. (Nutrition Abstracts & Reviews)

OKAL, A. Upotrebitelnost suroveho lecitinu na dokrm kacic.

USE OF CRUDE LECITHIN IN FINISHING DUCKS. *Pol'nohospodarstvo*, 1960, 7, 183-190. (Poultry Indust. Union, Ivanka pri Dunaji.) English and Russian summaries.—There were 2 groups of 450 Pekin ducks of about 2.1 kg. liveweight. For the experimental group 8 per cent. maize was replaced by crude lecithin. The consumption of nutrients was 1486.75 kg. for the experimental group and 1455.98 kg. for the controls. Weight gains were 251 and 243 kg. Experimental birds required 3.2 per cent. less feed per kg. weight gain.—A. Jancarik (Czechoslovakia). (Nutrition Abstracts & Reviews)

OSBOURN, D. F. and P. N. WILSON.
EFFECTS OF DIFFERENT PATTERNS OF ALLOCATION OF A RESTRICTED QUANTITY OF FOOD UPON THE GROWTH AND DEVELOPMENT OF COCKERELS. *J. Agric. Sci.*, 1960, 54, 278-289. (Imp. Coll. Trop. Agric., Trinidad.)—For 6 weeks from 18 days of age, 12 male chickens were given restricted feeding on a commercial pelleted growing ration which started at 14 g. per bird daily and increased every 2 days by 2 g. up to 56 g. daily. A similar group got the same total amount but with severe restriction for 10 days, then feeding to apeptite for 18 days followed by 14 more days with severe restriction. A control group was fed to appetite throughout. After 6 weeks the first 2 groups were fed to appetite until they reached 1100 g. liveweight: this was 11 days later than controls.

During restricted feeding growth of both groups was less than that of controls. When severely restricted birds were fed to appetite growth rate was 20 per cent. greater than that of controls, and at the end of the first period of full feeding these birds were heavier than the group on moderately restricted feeding. After the second period of restriction they lost that advantage, but both restricted groups reached the final weight at the same time. There was no significant difference between groups in total feed eaten, but the group on moderate restriction tended to be more efficient. During refeeding feed intake relative to bodyweight of severely restricted chickens was 20 per cent. greater than that of controls, and was greater also than that of the group moderately restricted when they too were fed to appetite, indicating that severity of restriction had a greater effect on appetite, than total restriction, which was the same for both groups.

The carcases of severely restricted birds had significantly more fat than controls, and signnificantly less fat free dry matter and percentage moisture. Weights of individual muscles and bones were recorded, showing some differences between groups, but it was not shown that the total ratio of muscle to bone was affected. Practical implications of the findings are discussed. (Figures 1 and 2 seem to be reversed, with wrong legends.)—T. D. Bell. (Nutrition Abstracts & Reviews)

PATRIK, I. A. Vysoko pitatel'nye raciony dlja otkorma cypljat samoklevom.
RATIONS OF HIGH NUTRITIVE VALUE FOR FATTENING CHICKENS WITH SELF-FEEDERS. *Pticevodstvo*, 1960, No. 6, 15-19. —The 2 experimental mixtures tested differed only in the main cereal component, which for one was maizemeal and for the other oatmeal without husks. The mixture were, per cent., maizemeal or oatemeal 60.7, barleymeal 21.3, sunflower cake 6.1, meat-and-bone meal 5.1, animal fat (technical quality) 4.8, mussel shell 1.5 and salt 0.5; for the first 10 days Mn, Co and penicillin were added. The two rations had energy value 233.4 and 244.5 Cal. (productive or metabolisable not stated) per 100 g., 11 and 13.4 per cent. digestible protein, 9.4 and 10.2 per cent. fat and little fibre. They were compared with an ordinary fattening meal with 183 Cal. per 100 g., 13.7 per cent. digestible protein and 4.3 per cent. fat. The rations were given to 3 groups each of 2000 chickens fattened for 22 days. Both high-energy rations gave very large weight gains with low expenditures of feed units and especially of protein per g. gain. At the end from 86 to over 90 per cent. of the meat was graded first class, against 25 to 34 per cent. on the ordinary production ration. The results were even better than those expected from cramming. Confirmatory experiments are reported.—D. Duncan. (Nutrition Abstracts & Rviews)

PEPPER, W. F., S. J. SLINGER and J. D. SUMMERS.
STUDIES WITH CHICKENS AND TURKEYS ON THE RELATIONSHIP BETWEEN FAT, UNIDENTIFIED FACTORS AND PELLETING. *Poultry Sci.*, 1960, 39, 66-74. (Dept. Poultry Husb., Ontario Agric. Coll., Guelph.)—In the first experiment with broiler chickens reared to 10 weeks the basal high-energy ration was supplemented with 2.5 or 5 per cent. stabilised fat, the energy : protein ratios remaining constant; each ration was given either as mash or pellets

without supplementary grain. Compared with mash, pellets increased rate of growth and improved feed efficiency at all fat levels, the difference in growth rate being greatest with the basal ration, the rate decreasing as the level of fat rose. Fat increased growth with mash rations but not with pelleted, and efficiency was improved also by fat added to the mash rations.

In a similar experiment with turkey poults reared to 24 weeks, similar additions of fat were made to the basal ration which was given as mash or pellets, with wheat and oats in separate compartments. Pelleting increased growth with the basal ration and that supplemented with 2.5 per cent. fat but with 5 per cent. fat pelleting had no effect on growth. Fat improved growth and feed efficiency with mash rations but with pelleted rations growth was not improved although there was an improvement in feed efficiency. Groups given pellets ate less of the mixture and more grain than those given mash, irrespective of fat level. With both mash and pellets raising the fat level increased the ratio of mixture to grain selected. Protein, utilisation was improved both by pelleting and by addition of fat but energy uitilisation was not afefcted.

In a final experiment with turkey broilers reared to 12 weeks mash and pelleted rations were used alone or supplemented with 4 per cent. fat or 5 per cent. of a mixture of fishmeal and dried whey, as sources of unidentified factors, or a combination of both supplements, energy : protein ratios being kept constant. Pelleting increased rate of gain and improved feed efficiency, most with the unsupplemented ration. Fat or unidentified factors or both improved gain but not significantly. Neithehr fat nor unidentified factors improved growth on the pelleted rations. Feed efficiency was improved by fat on all rations but unidentified factors had no effect.—J. S. Thomson. (Nutrition Abstracts & Reviews)

PEPPER, W. F., S. J. SLINGER, J. D. SUMMERS and **G. C. ASHTON.** ON THE PHOSPHORUS REQUIREMENTS OF CHICKENS FOR EGG PRODUCTION AND HATCHABILITY. *Canad. J. Animal Sci.*, 1959, 39, 182-192. (Dept. Poultry Husb., Ontario Agric. Coll., Guelph).—Hens were given an all-vegetable diet containing per cent., total P 0.38 and non-phytin P 0.11. Dicalcium phosphate or soft phosphate was added, each to supply 0.05 or 1.0 per cent. P. The Ca content was kept constant at 2.4 per cent. The suplements had no beneficial effect on bodyweight, egg weight, hatchability or bone ash at the end of the laying period of 44 weeks. It is concluded that an all-vegetable diet contains too much P for assessment of the P requirements of the laying birds.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

PERETICKAJA, N. P. Ispol'zovanie othodov piscevoj promyslennosti pri otkorme pticy.

USING BY-PRODUCTS OF THE FOOD INDUSTRY FOR FATTENING POULTRY. *Pticevodstvo*, 1960, No. 6, 21-23. (Inst. Pisc. Prom., Kransnodar.)—Phospholipids are produced as waste in the refining of sunflower, groundnut and soya bean oils. They could usefully be given to fattening chickens at 2 g. per head daily or added to the rations of young chickens or hens at 20 and of ducks at 30 g. per kg. concentrates.

Ducks can take 5 to 10 g. sugar beet pulp per kg. bodyweight daily with no ill effect on fattening results. They could also take the seeds and skins of tomatoes in the form of cooked waste at 65 to 70 g. per kg. bodyweight daily. Outer leaves of cabbage greatly improved fattening results of ducks when they were given as a supplement to meals.—D. Duncan. (Nutrition Abstracts & Reviews)

PREVO, A. A., K. N. TORICYN and **V. A. SAFROV.** Kombinirovannyj otkrom cypljat v kletkam.

COMBINED FATTENING OF CHICKENS IN CAGES. *Pticevodstvo*, 1960, No. 6, 19-21.—It was found possible to economise on concentrates and on labour costs of chickens intensively fattened if they were self-fed on a high-energy ration of the first 10 days and crammed

for the next 10 instead of being crammed for the whole 20 days. Costs per kg. gain were reduced by 28 per cent.—D. Duncan. (Nutrition Abstracts & Reviews)

PUDELKIEWICZ, W. J., and **L. D. MATTERSON.** (U. Connecticut, Storrs.)
A FAT-SOLUBLE MATERIAL IN ALFALFA THAT REDUCES THE BIOLOGICAL AVAILABILITY OF TOCOPHEROL. *Jour. Nutrition* 71 (2): 143-148. 1960.—The d, α-tocopherol in alfalfa is only about 1/3 available to the chick. It was discovered that a compound or compounds in the hot ethanol extract of alfalfa act antagonistically to tocopherol, increasing its excretion and decreasing its availability. The vitamin E of alfalfa, when separated from the rest of the meal, is fully available. The addition of pure d, α-tocopherol to a tocopherol-low lipid extract of alfalfa resulted in an excretion of tocopherol to the same extent as that of the tocopherol excretion when alfalfa was the source of d. α-tocopherol.—Auth. summ. (Biological Abstracts)

PUDELKIEWICZ, W. J., L. D. MATTERSON, L. M. POTTER, LORNA WEBSTER and **E. P. SINGSEN.** (U. Connecticut, Storrs.)
CHICK TISSUE-STORAGE BIOASSAY OF ALPHA-TOCOPHEROL: CHEMICAL ANALYTICAL TECHNIQUES, AND RELATIVE BIOPOTENCIES OF NATURAL AND SYNTHETIC ALPHA-TOCOPHEROL. *Jour. Nutrioin* 71(2): 115-121. 1960.—A chick bioassay method is described for comparing the potencies of *d* and *dl*, α-tocopherol with their respective acetate esters. It was found that *d*, α-tocopheryl acetate was 1.34 times more potent than *dl*, α-tocopheryl acetate as measured by liver tocopherol content, and *d* or *dl*, α-tocopherol were utilized equally as well as their respective acetate esters.—Auth. summ. (Biological Abstracts)

RENNER, R. and **F .W. HILL.**
STUDIES OF THE EFFECT OF HEAT TREATMENT ON THE METABOLIZABLE ENERGY VALUE OF SOYBEANS AND EXTRACTED SOYBEAN FLAKES FOR THE CHICK. *J. Nutrition*, 1960, 70, 219-225. (Dept. Poultry Husb., Cornell Univ., Ithaca, N.Y.)—Two groups of 10 chicks were given each experimental diet for 4 weeks from hatching. The only difference between the basal diets was that one contained 57.61 per cent. ground whole soya beans and the other had, per cent., extracted husked soya bean flakes 44.46, degummed soya bean oil 11.31 and cellulose 1.84. For different pairs of groups they were given raw or the soya bean fractions were autoclaved for different periods.

The growth value and metabolisable energy of both soya beans and the fractions were improved by autoclaving for 10, 40 or 60 min. at 4 lb. pressure at 107° C. and there was no significant difference between these treatments. Over-heating by autoclaving for 2 hr. at 15 lb. reduced the value of the beans below that obtained with correct heat treatment but they were still better than raw. The maximum meabolisable energy values were less than had been calculated; the discrepancy for the flakes was small and was ascribed to a difference in processing betweeen laboratory and commercial conditions, but the discrepancy for ground whole beans was greater. Study of apparent absorption suggested that the oil in the whole beans was less readily absorbed than that extracted and then added to the flakes, and that poor absorption of this oil would account for the lower energy value.—D. Duncan. (Nutrition Abstracts & Reviews)

REYNTENS, N. Le tetra-alkyl-ammoniumstearate en tant que stimulant de la croissance.
TETRA-ALKYLAMMONIUM STEARATE AS A GROWTH STIMULANT. *Rev. Agric., Brussels*, 1960, 13, 237-238. (Stat. Petit Elevage l'Etat, Gontrode.)—In a trial with 312 Sussex × Rhode Island Red chickens from day-old to 9 weeks, control groups were given the basal diet with or without penicillin, and experimental groups were given supplements of tetra-alkylammonium stearte, 0.004, 0.008, 0.012, 0.02 per cent., in addition to the basal diet without antibiotic. Growth was not as

good on the basal ration with penicillin as without the anibiotic, but less feed was required per unit weight gained. All diets with the stearate gave better growth and efficiency than the control, but at 9 weeks the improvement was significant only with 0.02 per cent. On average growth was 3.5 and efficiency 4.0 per cent. better. The effect was greatest in the first 3 weeks.—T. D. Bell. (Nutrition Abstracts & Reviews)

SAINI, S. S., A. L. GIANCHANDANI and N. S. GAREWAL.
FORTIFIED FEEDS CUT DOWN CHICKEN DEATHS. *Indian Farming*, 1960, 9, 14-16. (Model Poultry Farm, Delhi Cantonment.)—The use in rearing diets of antibiotic supplements derived from penicillin waste improved growth and reduced mortality, and proved economical.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

SAVAGE, J. E. and B. L. O'DELL.
ARGININE REQUIREMENT OF THE CHICK AND THE ARGININE-SPARING VALUE OF RELATED COMPOUNDS. *J. Nutrition*, 1960, 70, 129-134. (Dept. Poultry Husb., Univ. Missouri, Columbia.)—The basal diet was like that described in Abst. 5513, Vol. 24, with small modifications including the addition of 0.5 per cent. methionine. The 35 per cent. casein supplied 1.2 per cent. arginine in the diet. Graded amounts of arginine were added to the basal diet and to a similar diet with 1.5 per cent. added glycine. Arginine with the basal diet progressively improved weight gains of chickens in the first 4 weeks after hatching, with a maximum effect at 2.25 per cent. of the diet. Glycine further improved growth at all levels of arginine, and in presence of glycine the maximum effect of arginine was reached with 2.10 per cent.; thus glycine spared the requirement for arginine.

On the basal diet 2.0 per cent. creatine hydrate was as effective as 0.4 per cent. arginine, and when the arginine content was 1.8 per cent. 0.3 per cent. creatine was as effective as a further 0.25 per cent. arginine. Creatinine was almost as effective as creatine and guanidoacetic acid was about half as effective. When the arginine content was below the optimum, 3.0 per cent. glycine was more effective in improving growth than 1.5 per cent., but when there was ample arginine there was no benefit from excess glycine. When arginine was sufficient but no glycine was added to the basal diet creatine improved growth rate.—D. Duncan. (Nutrition Abstracts & Reviews)

SAXENA, H. C. (Raj. Coll. Agric., Udaipur, India.)
SOURCES OF UNIDENTIFIED GROWTH FACTORS FOR PRACTICAL POULTRY DIETS. I. THE VALUE OF FISH MEAL AND SKIM MILK FOR GROWING CHICKS.. *Indian Vet. Jour.* 37(2): 64-67. 1960.—Experimental diets were prepared by supplementing the basal diet with 5% fish meal 2.5% skim milk and 5% fish meal and 2.5% skim milk both. Addition of fish meal resulted in a highly significant increase in growth whereas skim milk produced only a slight but significant growth response. A much greater weight was obtained in the group in which both were fed.—K. N. Mehra. (Biological Abstracts)

SCHNEEBERGER, H. and A. SCHURCH. Ueber die Verwendung von Reserpin als Zusatz zum Futter landwirtschaftlicher Nutztiere.
USE OF RESERPINE AS A FEED SUPPLEMENT FOR LIVESTOCK. *Mitt. Geb. Lebensmittel. Hyg.*, 1959, 50, 523-532. (Inst. Haustierenahrung, ETH, Zurich.) French and English summaries.—In the first experiment 60 male Leghorn chickens were given a commercial mixture alone or with 0.5 or 2.5 mg. reserpine or 5.0 or 25 mg. *Rauwolfia* mother liquor per kg. feed. After 6 weeks choline chloride, 0.1 g. per bird daily, was added to drinking water to combat perosis, but failed to eliminate it completely. In the first 4 weeks weight gain of birds given the smaller amount of either tranquilliser was similar to that of birds given none; growth of birds given the larger amount was poorer. The incidence of perosis was greatest among birds given reserpine or the liquor.

In the 2nd experiment 930 day-old Dutch Blausperber × Leghorn chickens of both sexes had chicken feed for 3½ weeks, then a fatten-

ing mixture and fresh skimmed milk. Half had reserpine, 1.25 mg. per kg., throughout. After 12½ weeks birds of that group were 42.0 g. heavier than the others; the difference between the 2 groups was greatest in the last 3½ weeks. Males were heavier than females. There were slight signs of perosis, chiefly in the group without reserpine.

In the 3rd experiment, with 1950 Leghorn and Dutch Blue × Leghorn chickens of both sexes, the fattening mixture was supplemented from the 7th week with whole wheat and sour dairy residues. Group B had reserpine, 1.25 mg. per kg., for the entire 12 weeks and group C for the last 6 weeks only; group A had none. For males weight gain during the 1st half was poorest in group B and during the 2nd half in group A, but final differences were not significant. Reserpine reduced efficiency of feed utilisation of males in the 1st half, but gave a slight improvement in the 2nd. It adversely affected weight gain and feed utilisation of females throughout, but high envirnomental temperatures in the 2nd half may have contributed to this result. Reserpine had no clear effect on feather picking or on carcase yield.—I. R. Anderson. (Nutrition Abstracts & Reviews)

SCOTT, M. L., A van TIENHOVEN, EARL R. HOLM, and R. E. REYNOLDS. (Cornell U., Ithaca, N. Y.)

STUDIES ON THE SODIUM, CHLORINE AND IODINE REQUIREMENTS OF YOUNG PHEASANTS AND QUAIL. *Jour. Nutrition*, 71(3): 282-288. 1960.—Studies were presented which indicate that, under practical conditions, the Na requirement of both pheasants and quail is approximately 0.085%; the chlorine requirement is between 0.048 and 0.11%; and the iodine requirement is no more than 0.3 ppm of diet. The results of these studies indicate that the sodium and chlorine requirements of both pheasants and quail are satisfied by the addition to a practical ration of 0.15% of sodium chloride. If iodized salt is used, containing 0.007% of iodine, this level of 0.15% of salt also appears to satisfy the iodine requirement of both pheasants and quail.—Auth. summ. (Biological Abstracts)

SIMPSON, C. F., W. R. PRITCHARD and R. H. HARMS.

AN ENDOTHELIOSIS IN CHICKENS AND TURKEYS CAUSED BY AN UNIDENTIFIED DIETARY FACTOR. *J. Amer. Vet. Med. Assoc.*, 1959, 134, 410-416. (Dept. Vet. Sci., Univ. Florida, Gainesville.)—Clinical and pathological examinations were made on chickens from 7 to 12 weeks old, and on turkeys, from 75 poultry flocks where loss from "oedema disease" had occurred. There were 150 day-old White Leghorn cockerels, divided into 6 equal groups: 2 groups were fed on a complete basal diet and 4 on the same diet with 0.5, 1.0, 5.0 or 10.0 per cent. "toxic fat" obtained from a commercial manufacturer of poultry feeds. Clinical signs appeared on the 16th day and were identical with those occurring spontaneously. All the birds in the group receiving 10 per cent. "toxic fat" died after from 16 to 49 days, and those receiving 5 per cent. after from 47 to 98 days. The clinical signs and changes in blood picture and histological findings are described.—M. H. Pierce. (Nutrition Abstracts & Reviews)

SMETANA, P.

BETTER RATIONS FOR BROILER PRODUCTION. *J. Agric. W. Austral.*, 1960, 1 (4th Ser.), 241-251. (Poultry Res. Stat., Herdsman Lake.)—Four broiler feeding trials were made with the object of improving liveweight gain and feed conversion rate, which in Australia are less satisfactory than in the broiler industries of other countries. As a result a modified ration for use up to 12 weeks of age has been formulated; it contains wheatmeal, ground oats, bran, whalemeal, meatmeal, dried buttermilk powder, brewer's yeast, fat, vitamin A and D_3, NaCl and Mn. On this ration liveweight at 12 weeks was 3 lb. 6 oz. and the conversion rate 3.29, figures which compare favourably with those obtained on existing rations, 3 lb. at a conversion rate of 3.5. Though the cost of the ration is relatively high, the financial gain exceeds that obtained so far in the broiler industry.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

SMITH, R. E. and **T. M. MacINTYRE.**
THE INFLUENCE OF SOLUBLE AND INSOLUBLE GRIT UPON THE DIGESTIBILITY OF FEED BY THE DOMESTIC FOWL. *Canad. J. Animal Sci.*, 1959, 39, 164-169. (Canada Dept. Agric., Res. Branch, Nappan, N.S.)—The digestibility of the proximate constituents of a mash and grain ration and of a whole grain ration was estimated in individual birds before and after feeding grit. A solulbe calcitic limestone, insoluble quartz grit and silica sand were tested alone or in different combinations. When the ration was of whole grain only, any grit significantly increased the digestibility of all proximate constituents. When the diet was mash and grain the effect of grit was slight. Soluble and insoluble grits were equally effective, as long as they remained present as distinct entities in the gizzard. Quartz was retained in the gizzard for longer than calcite, so that more of the latter was taken.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

SOMMERFIELD, J. Fischpulpe als Dorschmehlersatz bei der Futterung von Legehennen.
REPLACEMENT OF COD MEAL BY FISH PULP IN THE FEEDING OF LAYING HENS. *Deutsch. Wirtschaftsgeflugelzucht.* 1960, 12, 165-166. (Bundesforschungsanst. Kleintierzucht, Celle.)—Three groups of 30 hens in the second year of laying were selected on the basis of egg yield and were fed once daily on mixed grains and for the rest of the time freely on laying rations which for the control group contained 7.5 per cent. cod meal and for the other groups the cod meal was reduced to 5.0 or 2.5 per cent. and 10 or 20 per cent. fish pulp was added.
Mean numbers of eggs laid in 350 days were slightly less in the groups given fish pulp, 157.7 and 152.6 against 161.5 in the hens given cod meal, but the group given 10 per cent. pulp laid much heavier eggs and the total weight of their eggs exceeded that of the control group. Both groups given fish pulp ate more laying meal than the controls; with 10 per cent. pulp, utilisation of the meal was as good as in the controls but with 20 per cent. it was poorer. It is considered that not more than 10 per cent. fish pulp should be used in laying rations.—D. Duncan. (Nutrition Abstracts & Reviews)

SOSINA, Z. M. (Dept. Human, Animal Anatomy, Physiol., Paedagogic Inst., Riazan, USSR.)
TECHNIQUE FOR THE INVESTIGATION OF DUODENAL DIGESTION IN POULTRY. *Fiziol. Zhur. SSSR* (Transl.) 45(11): 109-111. 1959. (Biological Abstracts)

SRIVASTAVA, B. K., H. C. SAXENA and **J. C. SHARMA.**
INFLUENCE OF DIETARY INTAKE OF CERTAIN INSECTICIDES ON THE HAEMOGLOBIN AND ERYTHROCYTE CONTENTS OF CHICK BLOOD. *Nature*, 1960, 186, 172-173. (Rajasthan Coll. Agric., Udaipur.)—Chickens 7 days old were fed to appetite on a practical ration to which was added, for 15 days, benzene hexachloride 25, dieldrin 1.25, DDT 35 or malathion 40 p.p.m. Blood samples were taken after 5, 10 and 15 days, and again 10 days after the insecticides had been discontinued. All the insecticides progressively reduced Hb values and red cell counts while they were being given. After 10 days without insecticide Hb value and red cell count returned to normal in the chickens given malathion but continued to fall in the others, in which there was high mortality, loss of weight and signs of a hock disorder similar to perosis.—T. D. Bell. (Nutrition Abstracts & Reviews)

STEINEGGER, P. and **G. ZANETTI.** Die Wirkung eines Zusatzes von Oleandomycin zum Mastfutter auf das Wachstum von Kuken.
EFFECT OF A SUPPLEMENT OF OLEANDOMYCIN TO A FATTENING RATION ON THE GROWTH OF CHICKENS. *Arch. Geflugelk.*, 1960, 24, 58-62. English summary.—For 12 weeks 5 groups of 67 Leghorn male chickens 3 days old were given the same all-mash ration with 1, 2 or 4 g. oleandomycin or 20 g. terramycin per 1000 kg. feed or no supplement. Average weight gains of the groups given anti-

biotic were 1.3, 2.4, 5.7 and 4.8 per cent. greater than in the group getting no supplement; kg. feed per kg. gain of the groups in the order given above was 3.25, 3.25, 3.13, 3.35 and 3.30. There was no significant difference in slaughter yield between the groups. Health and condition of all groups during the trial were good and losses were 7, 9, 6, 4 and 6 per cent., respectively.—R. G. Hankin. (Nutrition Abstracts & Reviews)

STUCKI, W. P., A. E. HARPER, and **C. A. ELVEHJEM.** (Dept. of Biochemistry, Univ. of Wisconsin, Madison.)
THE IMPORTANCE OF DISPENSABLE AMINO ACIDS FOR NORMAL GROWTH OF CHICKS. *Fed. Proc.* 19(1 Pt. 1): 12, 1960.—Abstracts. (Biological Abstracts)

SUPPLEE, W. C.
THE EFFECT OF ANTIBIOTIC SUPPLEMENTATION ON THE RESPONSE OF POULTS TO DIETARY CORN OIL. *Poultry Sci.*, 1960, 39, 227-229. (Dept. Poultry Husb., Univ. Maryland, College Park.)—The basal Drackett protein and sucrose diet contained 4 per cent, maize oil. Other rations were prepared containing 8.4, 13.3 and 18.7 per cent. maize oil at the expense of the sucrose on a productive energy basis, the weight of the ration decreasing and nutrient density increasing as the level of oil rose. The rations were given to day-old turkey poults for 21 days with or without a supplement of 50 mg. oleandomycin phosphate per kg. diet.

Growth responses to the further additions of oil were 2, 10 and 4 per cent., the last value being considered aberrant, without antibiotic and 7, 20 and 16 per cent. with antibiotic. Relative efficiency of feed conversion, adjusted for feed intake of controls, of the 4 rations without antibiotic was 0.78, 0.79, 0.80 and 0.74 and with antibiotic 0.88, 0.84, 0.81 and 0.79. This tendency to a decrease in efficiency with increased growth in the birds receiving the antibiotics might be explained if the antibiotic led to overconsumption of feed and therefore to an unusual fattening effect. The antibiotic reduced the weight of the intestine as a percentage of bodyweight but the level of oil had no apparent effect.—J. S. Thomson. (Nutrition Abstracts & Reviews)

SWART, L. G. and **C. R. LIEBENBERG.** 'n Voorlopige ondersoek oor die gebruik van lupiensaadmeel in kuikenrantsoene.
A PRELIMINARY INVESTIGATION OF THE USE OF LUPIN SEED MEAL IN CHICK RATIONS. *S. African J. Agric. Sci.*, 1959, 2, 543-549. (Stellenbosch-Elsenburgse Landboukoll, Stellenbosch.) English and French summaries.—Six groups of 30 White Leghorn chickens were given as the main source of protein fishmeal, or sweet lupin seed meal, or the lupin meal with 0.3 per cent. DL-methionine, or 5 μg. vitamin B_{12} per lb. feed, or both, alone or with 5 mg. aureomycin per lb. Growth and feed efficiency of chickens having lupin seed meal were improved by methionine or vitamin B_{12} or both, but aureomycin had little or no additional effect. Growth and feed efficiency were best with fishmeal. Lupin seed meal had no ill effect on survival or feather growth but caused droppings to be sticky.—I. R. Anderson. (Nutrition Abstracts & Reviews)

THOMKE, S. Uber die Verdaulichkeit eines aufgewerteten Magermilchpraparates bei Kuken.
DIGESTIBILITY OF AN ENRICHED SKIMMED MILK PREPARATION FOR CHICKENS. *Arch. Geflugelk.*, 1960, 24, 125-132. (Inst. Tierernahrung, Upsala.) English summary.—According to the manufacturers the preparation tested consisted, per cent., of dried skimmed milk 52, a whey preparation 20, tallow 15, lard 8, crude sugar 3.6, salt 0.4 and dicalcium phosphate 1, with added vitamins and 40 mg. terramycin per kg. Two groups of 4 chickens were given for the first week the standard rearing mash and then one group continued on the mash and the other group had a mixture of equal parts of the mash and the milk preparation. Digestibilities were studied for each of the next 8 weeks.

The digestibility of the organic matter of the standard mash did not change much in the course of the study but that of the milk preparation increased although it was never quite as high as that of the mash. There was a steady increase of digestibility of the N-free extract of the milk preparation, which was low to start with, and the fat was always more digestibile than that in the mash. Mean total weight gain in 8 weeks was 751 g. on the mash and 840 g. with the milk preparation. On the whole it is considered that products rich in lactose are of limited value for poultry feeding; the mash with only 5 per cent. sugar was much the better feed at the start..—D. Duncan. (Nutrition Abstracts & Reviews)

TITUS, H. W., A. L. MEHRING (Jr.), D. JOHNSON (Jr.), L. L. NESBITT, and T. TOMAS.

AN EVALUATION OF MCF (MICRO-CEL-FAT), A NEW TYPE OF FAT PRODUCT. *Poultry Sci.*, 1959, 38, 1114-1119. (Lime Crest Res. Lab., Limestone Products Corp. America, Newton, N.J.)—Micro-Cel-Fat (MCF) is a product containing tallow incorporated into Micro-Cel, a highly absorptive synthetic hydrated calcium silicate. In this form tallow may be stored without the use of special equipment for treatment.

Two rations were prepared from the same ingredients and containing as nearly as possible the same amounts of proximate principles, energy, minerals and vitamins, one with 6 per cent. tallow and the other 8 per cent. MCF, the tallow contents being similar. The heats of combustion were 1895 and 1889 Cal. per lb. respectively. Growth of chickens to 10 weeks was recorded, digestibility trials were made and metabolisable energy of the rations was calculated.

Weight of chickens at 10 days and efficiency of feed conversion were slightly, but not significantly higher on the MCF ration. The yield of metabolisable energy was 1194 Cal. per lb. for the tallow ration and 1235 Cal. for the MCF ration. Percentage digestibility of protein was the same in both rations, 88.8, and for tallow and MCF rations, respectively, that of fat was 88.9, and 89.6, and of N-free extract was 63.5 and 66.6; the difference in digestibility of N-free extract was significant. Digestibility coefficients previously published (Titus, "Scientific Feeding of Chickens", Interstate Printers, Danvillle, Ill., 2nd ed., revised, 1955) were protein 79.8, fat 85.3 and N-free extract 87.2 per cent. Added fat had therefore depressed the digestibility of the N-free extract when given as MCF and this is attributed to the presence of the Micro-Cel. The greater amount of metabolisable energy per calorie of heat of combution in the MCF ration is also attributed to the Micro-Cel.—J. S. Thomson. (Nutrition Abstracts & Reviews)

TOTH, M. Ipari szir alkalmazasa rantani valo csibe eloallitasara.

USE OF INDUSTRIAL FAT FOR REARING BROILERS. *Allattenyesztes* 1959, 8, 371-380. Kisallatt enycszt esi Kutatoint. Baromfitenyesztesi Oszt., Godollo.) Russian and German summaries.—Yellow Hungarian × Plymouth and purebred New Hampshire chickens, 1335 in all were given rations with the same starch value and protein contents, but some given industrial fat had 3 or 8 per cent. more crude fat than the others. After 8 weeks total weight gains in the crossbred chickens receiving 3 and 8 per cent. industrial fat were 680 and 720 g. and in the New Hampshires 670 and 680 g. compared with 620 and 590 g. when extra fat was not given for the 2 breeds, respectively. Feed efficiency was 5 to 10 per cent. better in the crossbred and 15 to 18 per cent. better in the New Hampshires given industrial fat.—R. G. Hankin. (Nutrition Abstracts & Reviews)

TOUCHBURN, PAUL SHERMAN.

THE EFFECT OF NUTRIENT DENSITY AND NUTRIENT INTERRELATIONSHIPS ON THE REPRODUCTIVE PERFORMANCE OF CHICKENS. Dissertation Absts. 20(10): 3931, 1960.—Abstracts. (Biological Abstracts)

TRIBOULET, G. Vitamine A et carotenes dans l'alimentation de la poule pondeuse.

VITAMIN A AND CAROTENES IN THE FEEDING OF LAYING HENS. *Thesis, Ecole Nat. Vet., Alfort,* 1959, No. 24, pp. 59. A review. (Nutrition Abstracts & Reviews)

TURK, DONALD EARLE.

EFFECT OF PROTEIN: ENERGY RELATIONSHIP AND OF ZINC IN POULTRY NUTRITION. Dissertation Absts. 20(10): 3945-3946, 1960.—Abstract. (Biological Abstracts)

URBANYI L. Kukenfutterungsversuche mit ausreichende Phosphor- und gruppenweise zunehmende Kalziumkarbonatmengen enthaltender Nahrung.

CHICKEN FEEDING TRIALS WITH DIETS CONTAINING SUFFICIENT PHOSPHORUS AND INCREASING AMOUNTS OF CALCIUM CARBONATE. *Acta vet. hung.*, 1959, 9, 285-296. (Forschungsinst. Tierzucht, Buadpest.)—The 6 groups of chickens were fed at first on millet and maize grits, then on a mixture of, per cent., barleymeal 40, maizemeal 20, wheat bran 25, sunflower seed meal 10 and bone-free meatmeal 5, with 0.4 per cent. NaCl and 2 per cent. $CaCO_3$ added. After 3 weeks the same basal diet with NaCl was given alone or with 1, 2, 3, 5 or 10 per cent. $CaCO_3$ for 4 weeks. The rations contained, as percentages of dry matter, Ca from 0.14 to 4.07, Mg from 0.26 to 0.29 and P from 0.63 to 0.70, and Ca : P ratios were from 0.20 to 6.46.

In the first period average weight gain was 82.4 g., with little difference between groups. In the period with different Ca intakes mean gains, in order of rising Ca intake, were 28.7, 82.6, 146.0, 176.4, 151.4 and 125.5 g., and air-dry feed per kg. weight gain was 11.89, 4.96, 3.63, 3.60, 4.16 and 5.49 kg. The average daily water intake by drinking was 25.01, 31.38, 40.61, 45.27, 40.69 and 41.56 g. The room had no sunlight and there was no vitamin supplement. Some chickens in all groups developed so-called leg-weakness and some were so hampered in their movements that they starved The groups least affected were those with 2 and 3 per cent. added $CaCO_3$; the number of birds which died of starvation, out of the groups of 17 were 5, 2, 1, 1, 1, and 6. When the birds were 6 to 7 weeks old they developed anaemia which responded to supplements of Fe and Cu.—D. Duncan. (Nutrition Abstracts & Reviews)

VAN PUYVELDE, A. L'incorporation de la vit. E dans les rations des poulets a l'engrais.

INCORPORATION OF VITAMIN E IN THE RATIONS OF FATTENING CHICKENS. *Rev. Agric., Brussels,* 1960, 13, 65-68. (Stat. de l'Etat Petit Elevage, Gontrode.)—Two groups of day-old chicks were fed on diets containing, per 100 g., fat 3.25 g. and vitamin E 1.04 mg., or 8.30 g. and 1.11 mg.; each group received suplements ranging up to 100 mg. vitamin E per kg. diet for up to 7 weeks.

Weight gain and feed consumption were the same for both groups and were unaffected by vitamin E supplements. Serum cholesterol was generally higher in male than in female chickens. The group eating more fat had higher serum cholesterol and lower liver fat; vitamin E had no apparent effect on these values.—A. Hepburn. (Nutrition Abstracts & Reviews)

VASIL'EV, P. A. Ispol'zovanie kukuruznogo silosa v korm ptice.

USING MAIZE SILAGE IN POULTRY FEEDING. *Pticevodstvo,* 1959, No. 8, 12-13. (Nutrition Abstracts & Reviews)

VELIKY, J. Koncentrat aminokyselin Peramin vo vyzive hydiny.

THE AMINO ACID CONCENTRATE PERAMIN IN POULTRY FEEDING. *Pol'nohospodarstvo,* 1959, 6, 229-242. (Inst. Tech. Microbiol. Biochem., Chem. Fac., Tech. Univ., Bratislava.) German and Russian summaries.—Peramin is a preparation obtained by combined hydrolysis of feathers with alkalis and acids. The amino acids found

by chromatography in the preparation are listed. In a trial with 7 groups of chickens supplemnts of 0, 1, 5, 8, 10, 15 or 20 per cent. Peramin were given. At the beginning of the experiment the chickens were 14 days old and the experiment lasted 60 days. The average final bodyweights of chickens in the experimental groups were 108, 140, 121, 116, 139 and 98.5 per cent. of that of controls. The weight gains were 111, 150, 128, 120, 148, and 98 per cent. Feathering was better in the groups given Peramin and the best flesh was in the groups given 8, 15 and 1 per cent. Peramin, in that order.—A. Jancarik (Czechoslovakia). (Nutrition Abstracts & Reviews)

VOHRA, P., J. B. ALLRED, I. S. GUPTA, and **F. H. KRATZER.**
FRACTIONATION OF SOYBEAN OIL MEAL FOR GROWTH AND ANTIPEROTIC FACTORS. 2. STUDIES WITH GENISTIN AND SOYSTEROLS. *Poultry Sci.*, 1959, 38, 1476-1477. (Univ. California, Davis.)—2. In part 1 (Abst. 3157, Vol. 30) it was shown that the growth-promoting and antisperosis factors in soya bean meal could be concentrated in the methanol fraction and that they were non-phospholipid in nature. Further studies of this fraction have been made.

When genistin, stigmasterol acetate, β-sitosterol, or crude soya sterols at levels of 0.033 or 0.2 per cent. or a mixture of 0.1 per cent. each of stigmasterol acetate and β-sitosterol were added to a basal Drackett protein ration with 28 p.p.m. Zn for turkey poults there was no improvement of growth and no effect on the incidence of perosis. The methanol extract of soya bean oilmeal added to the basal ration improved growth by from 16 to 21 per cent. Contrary to previous findings there was no effect on perosis. Provision of additional Zn, 57 p.p.m., in the rations had no further effect on growth but in all cases, even with the basal ration alone, the incidence of perosis was markedly reduced. The fact that stigmasterol prevents stiffness in guinea pigs but does not prevent perosis in turkeys is attributed to a species effect or to a difference in etiology.

It is concluded that the growth-promoting effect of soya bean oilmeal is not related to its content of free sterols.—J. S. Thomson. (Nutrition Abstracts & Reviews)

WAKELAM, J. A. (The Distillers Co., Broadway House, Wimbledon, London, Eng.) and **W. P. JAFFEE.**
GROWTH PROMOTING FACTORS IN MALT DISTILLERS DRIED SOLUBLES. *Brit. Jour. Nutrition*, 12(2): 147-158, 1958.—Field trials with 11,100 chickens and 200 turkey poults indicated positive growth responses to inclusion of either 2.5% dried distillers solubles in place of a like amount of dried skim milk, or of 5% dried distillers solubles in place of a like amount of barley. The response was greater for the latter substitution. Laboratory trials, employing adequate purified basal diets confirmed these results when the level of addition of distillers dried solubles was in the order of 2-3%. Above this level further increases were not significant. In general, the growth response averages +6-7%. It is suggested that the mode of action of distillers dried solubles may be similar to that of procaine penicillin in modification of intestinal flora.—J. E. Oldfield. (Biological Abstracts)

WEGNER, R. M. Legehennen-Futterungsversuch mit legemehl gleicher Zusammensetzung in gepresster und mehliger Form.
FEEDING TEST ON LAYING HENS WITH LAYING MEAL OF THE SAME COMPOSITION, AS PELLETS OR MEAL. *Arch. Geflugelk.*, 1959, 23, 270-276. (Inst. Tierzucht, Univ. Bonn.) English summary.—A commercial laying meal was given to appetite to 2 groups of 112 White Leghorn hens as meal or pelleted. A grain mixture, 50 g. daily, was also given.

From October to February total eggs laid per hen were 30.4 and 40.6, consumption of laying meal 51 and 66 g. daily and losses 7 and 4 birds. The eggs of the group receiving pellets were slightly heavier, but hatching results between February and April were somewhat inferior.

During the whole trial, from October to August, total eggs laid per hen were 134.0 and 137.3, consumption of laying meal 60 and 71 g. daily, intake of laying meal per 100 g. eggs 245.7 and 271.8 g., total feed per 100 g. eggs 450.4 and 463.2 g. and losses 14 and 18. Body-weight gains were 10.4 per cent. higher in the group getting pellets. Profits per hen were the same in the 2 groups—R. G. Hankin. (Nutrition Abstracts & Reviews)

WHARTON, F. D. (Jr.), I. OLCOTT, L. J. CLASSEN, R. E. APPLE and J. C. FRITZ.

ANORGANIC BONE AS A MEASURE OF CALCIFICATION IN THE A.O.A.C. VITAMIN D ASSAY. *J. Assoc. Off. Agric. Chem.*, 1959, 42, 623-624. (Dawe's Laboratories, Inc., Chicago 32, Ill.)—Fresh toes or tibiae from chicks were extracted for 30 hr. with ethylenediamine, washed with water and dried at 100° C. The residue of right tibiae as a percentage of fresh weight was about 1/7th of the weight of ash produced by the usual ashing procedure as a percentage of dry fat-free left tibiae. In two further studies, residues of toes were compared with ash of tibiae and the ratio was again about 1 : 7. Graphed on equalising scales, the responses to vitamin D were similar. The extraction of fresh bone with ethylenediamine is considered suitable for use where it would be simpler than ashing of dry, fat-free bone.—J. Quarterman. (Nutrition Abstracts & Reviews)

WHARTON, F. D. (Jr.), J. C. FRITZ, and L. J. CLASSEN.

STUDIES ON THE ABILITY OF SORBITOL AND VARIOUS SUGARS TO ENABLE CHICKS AND RATS TO SURVIVE DIETARY DEFICIENCIES OF SINGLE VITAMINS. *J. Nutrition*, 1959, 69, 74-80. (Nutrit. Res. Lab., Dawes' Laboratories, Inc., Chicago, Ill.)—Day-old or 6-week-old chicks did not survive on purified diets containing 20 per cent. sorbitol, fructose or sucrose in place of glucose unless thiamine was included in the diet. Added penicillin did not affect the growh or survival of chicks having fructose, sorbitol or glucose without thiamine. Diets lacking only choline were not improved by including sorbitol.

Without thiamine weanling rats given 20 per cent. sorbitol in the diet in place of glucose gained weight throughout 8 weeks; those having glucose or fructose lost weight after the third week. If weanling rats were kept in an unheated room at temperatures varying from 30° to 49° F. sorbitol failed to prevent signs of thiamine deficiency. In rats which received the sorbitol diet for 2 weeks before exposure to cold, growth was normal after a period of adjustment. Rats showed no apparent benefit from inclusion of penicillin in a thiamine-free diet.

Thiamine and riboflavin were estimated by standard methods in the faeces of rats on these diets. Less of both vitamins was excreted on diets containing sorbitol or fructose and no thiamine than on a diet containing glucose with thiamine.—A. M. Copping. (Nutrition Abstracts & Reviews)

WHITESIDE, C. H., T. M. FERGUSON, B. L. REID and J. R. COUCH.

THE EFFECT OF DEHYDRATED ALFALFA MEAL, DRIED BREWERS YEAST, CONDENSED FISH SOLUBLES AND FERMENTATION RESIDUE ON THE REPRODUCTIVE PERFORMANCE OF TURKEYS. *Poultry Sci.*, 1960, 39, 77-81. (Texas Agric. and Mech. Coll. System, College Station.)—Fifteen groups of Broad Breasted Bronze turkey hens which had been reared on range on a practical ration were given a diet of maize, milo and soya bean oilmeal with minerals, vitamins and antibiotics alone or supplemented with dried brewer's yeast (DBY) 5, condensed fish solubles (CFS) 5, a fermentation residue (FR) 5, or alfalfa meal (AM) 5 per cent., separately or in different combinations. Protein contents of the diets were similar.

Percentage hatchability of fertile eggs in the basal group was 49.4 and for the other groups as follows: DBY 68.1, CFS 65.6, FR 64.5, DBY + CFS 74.0, CFS + FR 71.5, DBY + FR 60.3, DBY + CFS + FR 73.1, AM 71.2, AM + CFS 67.2, DBY + AM 68.6 and CFS + DBY + AM 76.0. The failure of a combination of DBY and FR to increase

fertility over that obtained with the single supplements suggests that they contain the same or similar unidentified factors.

Egg production in the basal group during the 13-week period was 38.3 per cent. DBY increased this to 45.8 per cent. When DBY was given in combination with CFS, FR or AM increases over the basal ration were from 2.8 to 5 per cent. With a combination of DBY, CFS and FR production was 55.4 per cent. Egg production was not affected by addition of vitamin E during a subsequent period.

All the unidentified factor supplements and combinations increased average egg weight by from 2 to 7 g. Feed efficiency per egg produced was improved by the addition of DBY, CFS, FR or AM and by combined supplements containing DBY.—J. S. Thomson. (Nutrition Abstracts & Reviews)

WIENER, J. D., and **E. P. STEYN-PARVE.**
THE METABOLISM OF GLUCOSE IN NORMAL AND THIAMINE DEFICIENT PIGEONS. 1. THE CONVERSION OF GLUCOSE INTO GLYCOGEN, FATTY ACIDS AND RESPIRATORY CO_2. *Biochem. biophys. Acta*, 1959, 35, 473-484. (Lab. Physiol. Chem., Univ. Utrecht.)—1. Pigeons having a fat-free diet with or without thiamine for 10 days were given 4 g. glucose as carrier for glucose uniformly labelled with ^{14}C, supplying 8 μC. In a first experiment with 38 normal and 40 deprived pigeons, groups of 9 or 10 birds were killed 1, 2, 4 and 8 hr. after the glucose was given, and incorporation of ^{14}C into the glycogen and fatty acid fractions of the liver was measured. Incorporation of ^{14}C was much retarded in deprived birds. In a second test 50 μC. ^{14}C was given and the birds were killed 3 hr. later. ^{14}C in glycogen and fatty acids was measured in the rest of the carcase and in the liver. The deprived birds again showed a lower uptake of labelled glucose in all tests. The percentage of total ^{14}C intake incorporated into the carcase and into the liver was small in both normal and deprived birds. In a third experiment incorporation of ^{14}C from glucose into CO_2, measured in a simple respiration apparatus after 8 hr., was much less in deprived birds. There was no evidence of failure of absorption of glucose from the gut, and failure of recovery is attributed to blockage of some metabolic path. Even in normal pigeons most of the ^{14}C was not found in what might be considered the main metabolic pathways for glucose.—A. M. Copping. (Nutrition Abstracts & Reviews)

WIERTZ, G. Onderzoek naar een mogelijke invloed op de schildklier van toevoeging van antibiotica aan de rantsoenen van slachtkuikens en mestvarkens.
POSSIBLE EFFECT ON THE THYROID GLAND OF ADDING ANTIBIOTICS TO THE RATIONS OF TABLE CHICKENS AND FATTENING PIGS. *Tijdschr. Diergeneesk.*, 1960, 85, 464-474. (Lab. Fysiol. Dieren, Landbouwhogesch., Wageningen.) English, French and German summaries.—Eighty White Leghorn × New Hampshire chickens had a normal or high-energy ration with adequate I content, alone or with procaine, penicillin, 5 mg. per kg. meal up to 8 weeks, and were slaughtered at 71 days of age. Sixty others had the normal ration alone, or with penicillin up to 6 weeks or until slaughter at 81 days of age. Stained sections of thyroid were examined and histological activity was assessed numerically from height of the epithelium and follicular appearance.

The gland was examined also in 18 bacon pigs fattened from about 25 to 90 kg. on a normal ration or on one in which half of the animal protein had been replaced by vegetable protein. Some on each ration had also 20 g. aureomycin per 1000 kg. feed. In another group, of 32 terramycin, 10 g. per 1000 kg. was used.

The antibiotics did not have a consistently good effect on rate of growth except in the groups of pigs given aureomycin. Neither the antibiotics nor the special rations had any effect on histological activity of the thyroid.—I .R. Anderson. (Nutrition Abstracts & Reviews)

WILLINGHAM, H. E., K. C. LEONG, L. S. JENSEN and J. McGINNIS.
INFLUENCE OF GEOGRAPHICAL AREA OF PRODUCTION ON RESPONSE OF DIFFERENT BARLEY SAMPLES TO ENZYME SUPPLEMENTS OR WATER TREATMENT. *Poultry Sci.*, 1960, 39, 103-108. (Dept. Poultry Sci., Washington State Univ., Pullman.)—The discordant results obtained by different workers on the effect of enzyme or water treatment of barley on the growth of chickens were investigated.

Eleven samples of barley collected from different areas in the United States and Canada were given, untreated or treated with fungal or bacterial enzymes or treated with water, to day-old chicks for 2 to 3 weeks. Striking differences in growth rate were obtained with the different untreated samples. In all but 2 samples water treatment significantly improved growth rate and the improvement was greatest with the barleys which, untreated, gave poorest results. Only in a few samples was growth rate improved by enzyme treatment, and growth was slightly better when fungal rather than bacterial enzymes were used.

Growth response to the untreated samples of barley could not be related to their content of proximate principles and there was no indication that a high fibre content is necessary before enzymes exert their maximum effect.

To study the reasons for the variation in nutritive value of barley grown in the different areas, a comparison was made between a blend of barleys, which had given a poor response to enzymes in the above experiment, and another type. The barleys were untreated, treated with fungal enzymes, wet autoclaved or both. With the untreated barleys, growth and feed efficiency were superior with the barley blend. The other barley was significantly improved by the addition of enzymes but there was only a slight improvement when enzymes were added to the barley blend. Wet autoclaving reduced nutritive value in both cases but the reduction was much greater with the barley blend. Addition of enzymes to the wet-autoclaved barleys produced a significant improvement in growth rate and it was concluded that the barley blend contained more of a heat-labile factor, which was destroyed by wet autoclaving, than the other barley and that the factor may be an enzyme produced on the barley by micro-organisms before harvesting.—J. S. Thomson. (Nutrition Abstracts & Reviews)

WOOD, J. D., and J. BIELY.
A SUBSTANCE IN LING-COD LIVER OIL WHICH PREVENTS HYPERCHOLESTEROLAEMIA IN CHOLESTEROL-FED CHICKENS. *Nature*, 1960, 185, 473-474. (Fish. Res. Board Canada, Technol. Stat., Vancouver, B.C.)—Maize, herring and lingcod liver oils were saponified with KOH in ethanol and the soap solutions were repeatedly extracted with ethyl ether to give unsaponifiable material. The soap solutions were then acidified with HCl and free fatty acids were extracted with ethyl ether. The whole oils or their components were added at 10 per cent. oil or its equivalent to a diet with 1 per cent. cholesterol and given for 9 days to chickens 2 weeks old.

The rise of serum cholesterol produced by the diet without addition was prevented by lingcod oil and was greatly increased by maize or herring oil or by the free fatty acids from all 3 oils. The unsaponifiable fractions from maize and herring oils had little effect but that from lingcod oil completely prevented the rise of serum cholesterol.—D. Duncan. (Nutrition Abstracts & Reviews)

WORDEN, A. N.
CALCIUM LACTATE AS A DIETARY SUPPLEMENT FOR LAYING HENS. *Vet. Rec.*, 1960, 72, 234. (Nutrit. Res. Unit, Huntingdon.) (Nutrition Abstracts & Reviews)

YANG, S. P., H. E. CLARK, and G. E. VAIL.
NUTRITIONAL VALUE OF TURKEY PROTEINS. *J. Amer. Dietetic Assoc.*, 1959, 35, 1251-1254. (Dept. Foods Nutrit., Agric. Exp. Stat., Purdue Univ., Lafayette, Ind.)—Leg meat from female turkeys was dried in a VirTis macro freeze-drier. Groups of 10 male weanling

rats were fed to appetite for 4 weeks on an adequate diet containing dried turkey meat to provide 5, 10, 15 or 20 per cent. protein; control groups were given vitamin-free casein instead of turkey meat. The biological value of the protein was calculated from N balance measured during the last 7 days of experiment; the rats were then killed and moisture, N and fat were estimated in liver and carcase.

Average food intake, weight gain and protein efficiency ratio on the diets containing turkey meat at the 5 or 10 per cent. protein level were significantly greater than on the comparable casein diets. There was no measurable difference between the nutritive value of proteins at the 15 or 20 per cent. protein level. It is suggested that the superiority of turkey proteins at the lower levels may be due to the difference in sulphur amino acid content.—G. F. Garton. (Nutrition Abstracts & Reviews)

YOSHIDA, M., and H. MORIMOTO.
NUTRITIVE VALUE OF SWEET POTATO AS CARBOHYDRATE SOURCE IN POULTRY FEED. 2. EFFECT OF SWEET POTATO FEEDING ON DAY-OLD CHICKS. *Bull. Nat. Inst. Agric. Sci., Japan* (G), 1959, No. 18, 7-14. Japanese summary. For part 1 see Abst. 3119, Vol. 28.—2. Three groups of day-old White Leghorn male chicks were given diets which contained ground yellow maize 50, or maize 25, sweet potato 22.5 and fishmeal 13.3, or sweet potato 45 and fishmeal 16 per cent. The fishmeal was added to maintain a constant crude protein content. The mean liveweight gain on the diet without sweet potato was 164 g.; with sweet potato and maize it was 81 per cent. and without maize it was 55 per cent. of that amount. Mortality in the same order, was 25 and 60 per cent. Percentage digestibility of carbohydrate in the diet was 81, 73, and 74. When the diet without maize was heated at 120° C. for 1 hr. digestibility increased to 78 per cent. weight gain rose to 94 per cent. of that on the diet without sweet potato and mortality was reduced to 2 per cen.t Heating to 100° C. did not produce such consistently beneficial results.

Extraction of the sweet potato flour wtih ethyl ether, ethyl alcohol or water did not remove the harmful constituents of the flour.

Examination post mortem of the chicks given sweet potato flour showed that internal organs were underdeveloped and that there was bleeding of the duodenal mucosa. Liver slices stained with haematoxylin and eosin showed no abnormality.—M. E. Falconer. (Nutrition Abstracts & Reviews)

ZENISEK, Z., Z. MULLER. 1960. (Central Control Agricultural Institute, Prague, and Antibiotic Research Institute., Prague, Czechoslovakia). Pusobeni antibiotik na hladinu aminokyselin y organismu kurat.
THE INFLUENCE OF ANTIBIOTICS ON THE AMINO ACID LEVEL IN THE ORGANISM. (Summary in English and Russian) Sbornik CSAZV, zivocisna vyroba 5, 1: 59-66.—The most important amino acids were determined in the blood and feces of chickens experimentally fed antibiotics. There was no substantial difference of amino acids in blood between experimental and control chickens, with the exception of glutamic acid, the content of which increased in penicillin-fed chickens whereas the content of serine decreased. In the last phase of the growth, these differences disappeared. A lower content of proteins was found in the feces of penicillin-fed chickens as compared with controls which had not received antibiotics.—V. Orel.

ZENISEK, Z., R. PETKOVA. 1960. (Central Control Agricultural Institute, Prague, Czechoslovakia) Vysledky pokusu s nitrovanymi slouceninami furfurolu u kachen.
EXPERIMENTAL FEEDING OF DUCKS WITH NITRATED FURFUROL COMPOUNDS. (Summary in German and Russian) Sbornik CSAZV-zivocisna vyroba, 5, 1:67-74.—Experimental feeding of ducks with the addition of Furazolidone and Nitrofurazone at the level of 1 g. to 10 kg. of the fodder. The live weight of experimental ducks has been 16 per cent. higher than that of the control ducks.—V. Orel.

PATHOLOGY

ANCEL, P. 1959. [Lab. Embryol. Exp., Coll. France, Paris.] Recherches sur les malformations determinees par le refroidissement temporaire de l'oeuf de poule et compatible avec la vie des poussins. RESEARCH ON MALFORMATIONS CAUSED BY TEMPORARY COOLING OF THE HEN'S EGG AND COMPATIBLE WITH CHICK VIABILITY. *J. Embryol exp. Morph.*, 7: 330-334.—A table shows the lethal and teratogenic effects of cooling Leghorn eggs for a 48 hr. period during incubation. The type of abnormality depended on the stage of incubation at which exposure to cold occurred. A 12-mth-old cock hatched from an egg cooled between the 4th and 6th day of embryonic life showed localised bilateral ablephary but appeared to be other wise normal. (Animal Breeding Abstracts)

BELANGER, L. F.
OBSERVATIONS ON THE MANIFESTATIONS OF OSTEOLATHYRISM IN THE CHICK. *J. Bone and Joint Surg.*, 1959, 41-B, 581-589. (Dept. Histol., Sch. Med., Univ. Ottawa.)—Chicks initially one day or 10 days old received for 7 days diets of equal parts Purina growing mash and ground sweetpea seeds. Control chicks received the mash only.

Food intake of the chicks given sweetpea fell rapidly after 2 days but weight did not fall so sharply and was 85 per cent. of that of the control chick after a week. From the fourth day some experimental birds had crooked toes, the beak became asymmetrical, subcutaneous haemorrhages appeared and the feathers on the wings became ruffled and discoloured. The chicks were at first nervous and later apathetic. By the seventh day 4 birds of the first group and 5 of the second were unable to stand.

The histological findings are described and illustrated. The skeleton chiefly was affected. One chick had a meningeal tumour. Cartilage was depleted of both neutral and acid polysaccharides. In bone the primary change appeared to be deposition of minerals in the cytoplasm of osteoblasts and osteocytes, followed by disintegration of the cells, osteporosis and deposition of mineral in marrow spaces. It is suggested that the toxic effect of sweetpea seed may be exerted through poisoning of enzymes in the bone-forming cells. The appearance of minerals within the cells suggested that the cells may act directly in calcification.—D. Duncan. (Nutrition Abstracts & Reviews)

PHYSIOLOGY

ADAMS, A. E. (Mt. Holyoke Coll., South Hadley, Mass.)
REACTION OF THYROIDS OF CHICK EMBRYOS TO LARGE DOSES OF THYROXINE. *Anat. Rec.* 137(3): 334. 1960.—Abstract. (Biological Abstracts)

AMES, STANLEY R., WILLIAM J. SWANSON, and **PHILIP L. HARRIS.** (Research Laboratories, Distillation Products Industries, Division of Eastman Kodak Company, Rochester, New York.)
STUDIES ON A FACTOR CAUSING PERICARDIAL EDEMA IN CHICKS AND ITS OCCURRENCE IN SOME OLEIC ACIDS. *Fed. Proc.* 19(1 Pt. 1): 323. 1960.—Abstract. (Biological Abstracts)

BEVELANDER, GERRIT, HIROSHI NAKAHARA, and **GLORIA E. ROLLE.** (New York U. Coll. Dentistry, N. Y. C.)
THE EFFECT OF TETRACYCLINE ON THE DEVELOPMENT OF THE SKELETAL SYSTEM OF THE CHICK EMBRYO. *Development Biol.* 2(3): 298-312. Illus. 1960.—To test the effects of tetracycline on growing bone, the compound was injected in amounts ranging from 0.1-5.0 mg into the yolk sac of 8 day embryos. In amounts of 0.5 mg the drug is rapidly distributed throughout the embryo in a few hours. Later, it is localized exclusively in the mineralized parts of the embryo where it was identified in U. V light. Higher levels, 2.5-5.0 mg result in pronounced retardation in overall growth and a marked malformation and lack of mineralization of the long bones.—Authors. (Biological Abstracts)

BIERER, B. W. and **C. L. VICKERS.**
THE EFFECT ON EGG SIZE AND PRODUCTION OF FUNGICIDE-TREATED AND FUMIGATED GRAINS FED TO HENS. *J. Amer. Vet. Med. Assoc.*, 1959, 134, 452-453. (Livestock Sanit. Dept., Clemson Coll., Columbia.)—For 2 weeks 2 pens of 12 caged laying hens were given mash and untreated oats, to estimate the normal size and number of the eggs. For 23 days one pen then received oats treated some months previously with ethylene dibromide. The number of eggs laid remained constant but the size diminished. When the same birds were fed for 10 days on oats treated with a fumigant containing ethylene dibromide in an amount 10 times that recommended by the manufacturer, the size and number of the eggs declined rapidly and continued to do so during the following 2 weeks on normal feed. When they started to lay again the birds that had ceased laying altogether produced eggs weighing less than 18 oz. per dozen, and the effects were still apparent after 6 weeks.—M. H. Pierce. (Nutrition Abstracts & Reviews)

BIGLAND, C. H., and **D. C. TRIANTAPHYLLOPOULOS.** (U. Alberta, Edmonton.)
A RE-EVALUATION OF THE CLOTTING TIME OF CHICKEN BLOOD. *Nature* 186(4725): 644. 1960. (Biological Abstracts)

BOSE, A. (Presidency Coll., Calcutta, India.)
TRANSPORT OF THERMAL ENERGY ACROSS THE ORGANIZATION CENTRE OF CHICK EMBRYO. *Wilhelm Roux-Arch. Entwickmech. Organ.* 152(2): 160-165. Illus. 1960.—Touching the blastoderm with a hot needle has more drastic effects when applied to the mid- or posterior regions than when applied to the anterior region. The epiblast is more sensitive than the hypoblast.—F. Moog. (Biological Abstracts)

BRAHAM, J. EDGAR, CARLOS TEJADA, and **RICARDO BRESSANI.** (Inst. Nutrition, Cent. America and Panama (INCAP), Guatemala.)
CHEMICAL AND HISTOLOGICAL EFFECTS OF LYSINE DEFICIENCY ON THE FEMURS OF NEW HAMPSHIRE CHICKS. *Fed. Proc.* 19(1 Pt. 1): 2, 1960.—Abstract. (Biological Abstracts)

BRAEKKAN, O. R., H. MYKLESTAD, L. R. NJAA and **F. UTNE.**
VITAMIN A ISOMERS IN THE LIVER OF RATS AND CHICKS. *Nature*, 1960, 186, 312. (Govt. Vitamin Lab., Norwegian Fish. Res. Inst., Bergen.)—The vitamin A isomers were studied by a method which distinguishes only between those which react slowly or rapidly with maleic anhydride (see Plack, Abst. 267, Vol. 27). Rats were given, by dropper, synthetic vitamin A acetate or palmitate, *neo*vitamin A alcohol or ester, or a vitamin A concentrate with 30 per cent. *neo*vitamin A, in arachis oil. The fresh livers contained very little of the slow-reacting isomers unless the rats had been given them. This was found also in a few tests with chicks given vitamin A palmitate or *neo*vitamin A ester.

Homogenised rat livers originally devoid of slow-reacting isomers were found to contain 14 per cent. after storage for 7 days at 18° C.; at 4° C. or below little was formed.

It was concluded that fast-reacting isomers are the natural forms in the liver of rats and chicks, contrary to the result of Brown *et al.* (Abst. 3662, Vol. 30).—W. M. Deans. (Nutrition Abstracts & Reviews)

BRENES, LUIS, MELVIN KAHN, DOUGLAS DAVIDSON, and **JACK ORLOFF.** (National Heart Institute, Bethesda, Md.)
THE EFFECT OF AMMONIUM SALTS ON ELECTROLYTE EXCRETION IN THE CHICKEN. *Fed. Proc.* 19 (1 Pt. 1): 366. 1960.—Abstract. (Biological Abstracts)

BUYS, G. S. and **D. J. J. POTGIETER.**
A SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF URIC ACID IN POULTRY EXCRETA. *S. African J. Agric. Sci.*, 1959, 2, 499-506. (Fac. Agric., Univ. Pretoria.) Afrikaans and

French summaries.—About 1 g. dried ground excreta was extracted by shaking wtih 100 ml. 0.5 per cent. Li_2CO_3 for 1 hr. then twice with 50 ml. for ½ hr.; the extract was made up to 250 ml. with Li_2CO_3. A 10-ml. portion was deproteinised with 10 ml. 6 per cent. $HClO_4$. Five ml. filtrate was added with stirring over 4 min. to 1 ml. 0.1 *M* mercuric acetate in 5 per cent. acetic acid in a centrifuge tube in boiling water and heating was continued for 6 min. After cooling and centrifuging, the supernatant fluid was removed and the precipitated mercuric urate was washed by suspending in 5 ml. of filtrate obtained by mixing 1 litre 0.01 *M* mercuric acetate in 1 per cent. acetic acid and 10 mg. uric acid in water. It was then dissolved in a few ml. 0.5 *M* NaCl in 1 per cent. acetic acid and made up to 100 ml.; the absorption was measured at 290 mμ.—A. Hepburn. (Nutrition Abstracts & Reviews)

CALDWELL, CLYDE T., and **DELBERT E. SUYDAM.** (Upjohn Co., Kalamazoo, Mich.)

COMPARISON OF CHOLESTEROL AND ESTROGEN-INDUCED ATHEROSCLEROSIS IN COCKERELS. *Proc. Soc. Exptl. Biol. and Med.* 104(1): 133-135. 1960.—Artery and blood serum changes associated with atherosclerosis induced in young cockerels with pharmacologic amounts of estrogen and cholesterol, separately and combined, were compared. A critical level of estrogen caused more rapid plaque formation than cholesterol, and the degree of hypercholesterolemia did not determine the extent of atheromatosis.—Authors. (Biological Abstracts)

CAYLOR, J. F. and **C. K. LAURENT.**

THE EFFECT OF A GRAM FUMIGANT ON EGG SIZE OF WHITE LEGHORN HENS. *Poultry Sci.*, 1960, 39, 216-219. (Marbut Milling Co., Inc., Augusta, Ga.)—When oats or maize fumigated with a mixture of carbon tetrachloride, ethylene dichloride and ethylene dibromide were given to hens there was a marked decrease in egg weight. the decrease being greater with oats. Egg production was affected only when oats were fumigated at a level of 1.5 ml. fumigant per lb. grain.—J. S. Thomson. (Nutrition Abstracts & Reviews)

CECIO, A. Azione dell'acido orotico sulle gonadi femminili. Ricerche istologiche in polli in accrescimento.

EFFECT OF OROTIC ACID ON THE FEMALE GONADS. HISTOLOGICAL STUDY ON GROWING CHICKENS. *Boll. Soc. ital. Biol. sper.*, 1960, 36, 339-342. (Ist. Anat. Normale Vet., Univ. Naples.)—Groups of 4 pullet chicks 15 days old, on a balanced diet, were given 150 or 1200 mg. orotic acid per kg. feed or none for 43 days and were then killed. The ovaries were fixed and stained.

The smaller dose of orotic acid arrested maturation of follicles, so that the ovaries showed a greater proportion of primordial to maturing follicles than those of the untreated pullets. With the larger dose there was more definite disorganisation which affected also the connective tissue of the ovary.—D. Duncan. (Nutrition Abstracts & Reviews)

CENTURY, B., M. K. HORWITT and **P. BAILEY.**

LIPID FACTORS IN THE PRODUCTION OF ENCEPHALOMALACIA IN THE CHICK. *Arch. Gen. Psychiat.*, 1959, 1, 420-424. (Biochem. Res. Lab., Elgin State Hosp., Ill.)—Day-old chicks were given, for 28 days, a synthetic diet lacking in tocopherols and supplemented with oils freed from tocopherols. When the diet contained 4 per cent. maize oil, encephalomalacia developed in 80 per cent. of the chicks. Cerebellar petechiae, haemorrhages and necrotic lesions were found. The haemorrhages involved both the molecular and the granular layer of the cerebellum, and were preceded by pyknosis of the Purkinje cells. A supplement of D-α-tocopheryl acetate, 4 mg. per bird per week, prevented the signs. With smaller amounts of maize oil, less tocopherol was required. Safflower, soya bean and cottonseed oil, and lard, which, like maize oil, are rich in linoleic acid, also gave a high incidence of encephalomalacia. Butter or coconut oil, low in linoleic acid, produced no signs of encephalomalacia, but when coconut oil was added to a diet

containing 3 or 5 per cent. safflower oil or 1 to 2 per cent. maize oil, the incidence of encephalomalacia was increased.—E. M. Cruickshank. (Nutrition Abstarcts & Reviews)

CESKA, M. and **J. R. FISHER.**
AN ARGINASE INHIBITOR(S) AND ITS POSSIBLE ROLE IN THE DEVELOPMENTAL DECREASE OF ARGINASE ACTIVITY IN CHICK EMBRYOS. *Biol. Bull.*, 1959, 117, 611-625. (Dept. Chem., Florida State Univ., Talahassee.) (Nutrition Abstracts & Reviews)

CHUBB, L. G. (Houghton Poultry Res. Sta., Houghton, Huntington, Eng.), and **J. G. ROWELL.**
COUNTING BLOOD CELLS OF CHICKENS. Jour. Agric. Sci. 52(2): 263-272. Illus. 1959.—Although blood counts varied only slightly during the day, there were considerable differences from day to day. The average erythrocyte count for 10 chickens is between 2.9 and 3.5 millions per mm^3 during the first 3 weeks after hatching and was more steady for the next 4 weeks at about 2.9 millions per mm^3. The average leucocyte count rose from about 10,000 to 35,000 per mm^3 during the first 7 weeks of life, the rate of increase being greatest when the chickens were youngest; the raise was mainly due to a rise in the number of lymphocytes. A comparision of the various counting methods and sampling errors in counts is also given.—V. Raghavan. (Biological Abstracts)

CHUNG, C. W., H. R. MAHLER, and **MARY ENRIONE.** (Indiana U., Bloomington.)
INCORPORATION OF ADENINE NUCLEOTIDE INTO RIBONUCLEIC ACID BY CYTOPLASMIC ENZYME PREPARATIONS OF CHICK EMBRYOS. Jour. Biol. Chem. 235(5): 1448-1461. 1960.—Chick embryonic tissues contain an enzyme system catalyzing the incorporation of labeled pyrophosphate into nuceloside tri- but not diphos phates, in the presence of added cytoplasmic ribonucleic acid (RNA). The same preparations were also capable of incorporating C^{14}-adenosine triphosphate (ATP) into added RNA both in the presence or the absence of other mucleoside triphosphates. The crude enzyme (Type I enzyme preparation) yielded a more highly purified preparation (Type II enzyme preparation) by fractionation. Both Type I and II enzyme preparations required Mg^{++} for ATP-C^{14} incorporation and showed no incorporation of adenosine diphosphate-C^{14} even in the presence of mixtures of cytosine diphosphate (CDP), uridine diphosphate (UDP), and guanosine diphosphate (GDP). The pH optimum for ATP-C^{14} incorporation was between 9.0 and 9.5. With the Type II enzyme preparation, the incorporation of ATP-C^{14} into RNA was essentially unaffected by the addition of cytosine triphosphate (CTP), uridine triphosphate (UTP), guanosine triphosphate (GTP), or a mixture of the 3, and could be shown to be mostly at the terminal position of the polynucleotide chain. The ATP-C^{14} uptake into RNA catalyzed by the Type I enzyme preparations was stimulated 2-to 5-fold by the addition of CTP, UTP, and GTP, singly or in combination. In the presence of a mixture of the 3 triphosphates and of an optimal concentration of MG^{++}, the enzyme activity was further stimulated by the addition of Mn^{++}. Under these conditions some 70 to 80% of the total incorporated activity could be demonstrated to be in internucleotide linkage. The enzyme activity was inhibited by anionic polymers including deoxyribonucleic acid (DNA) at relatively high concentrations. At lower concentrations there was some stimulation of activity, with DNA more effective than the other agents tested. Spermidine and cadaverine stimulated enzymatic activity at relatively high, but were inhibitory at lower concentration. The significance of these findings with regard to the synthesis of RNA in the cytoplasm of animal cells is discussed. (Biological Abstracts)

CROSTI, NICOLETTA. (Bryn Mawr Coll., Pennsylvania.)
CALCIUM DEPOSITION IN THE FORELIMBS OF THE CHICK EMBRYO. Anat. Rec. 136(4): 453-456. Illus. 1960.—The 1st deposition of Ca in the skeleton of the chick limb bud has been shown by the staining of sections with alizarin red S to occur during the 8th day in

the humerus. This deposition of Ca salts is followed 12-24 hours later by others in the ulna and radius. These results indicate that alizarin red S is satisfactory for demonstrating the deposition of Ca salts in sections of bone.—Auth. summ. (Biological Abstracts)

DICKERSON, J. W. T.

THE EFFECT OF GROWTH ON THE COMPOSITION OF AVIAN MUSCLE. *Biochem. J.*, 1960, 75, 33-37. (Med. Res. Counc. Dept. Exp. Med., Univ. Cambridge.)—Bodyweight of cockerels doubled in the first 2½ weeks after hatching, with concurrent tenfold increase in the weight of pectoral muscle. In muscle the concentrations of water, Cl, Na and extracellular protein N decreased and those of K, P and Mg increased during the first 2½ weeks. K and P then fell to a lower level maintained in the adult. Fibrillar proteins increased mainly in the first 2½ weeks, and sarcoplasmic proteins mainly between 2½ and 4 weeks. At 4 weeks muscle had almost adult composition.

The amount of protein N per litre cell water rose but the amount of Na and K per litre fell. It is suggested that change in shape of the muscle during the first 2½ weeks accounts for its rapid increase in weight. The influence of the uneven distribution of cellular constituents on cell composition is discussed.—B. M. Wilson. (Nutrition Abstracts & Reviews)

ELIASSEN, EINAR. (U. Bergen, Olso, Norway.)

A METHOD FOR MEASURING THE HEART RATE AND STROKE/PULSE PRESSURES IN BIRDS BY NORMAL FLIGHT. Univ. Bergen Arbok Mat-Nat. Ser. 1960 (12):1-22. Illus. 1960.—A wireless transmitter system is constructed to make possible registrations of heart rate, stroke pressure, and aortic pulse pressure in birds during normal flight. The transmitter consists of an oscillator and an electromechanical transducer. The receiving part of the system is a conventional receiver for frequency modulated waves. By means of this apparatus we have succeeded in registrating both heart rate and vascular pressures at a distance. All experiments were carried out in 1957-59.—Auth. summ. (Biological Abstracts)

GEORGE, J. C., S. MADHAVAN NAIR, and **K. S. SCARIA.** (M. S. Univ. Baroda, India.)

STUDIES ON THE STRUCTURE AND PHYSIOLOGY OF THE FLIGHT MUSCLES OF BIRDS. 3. ALKALINE PHOSPHATASE ACTIVITY IN THE PIGEON BREAST MUSCLE. Current Sci. 27(5): 172-173. Illus. 1958. (Biological Abstracts)

GEORGE, J. C., and **K. S. SCARIA.** (M. S. Univ. Baroda, India.

ACTIVATION OF PIGEON PANCREATIC LIPASE BY MERCURIC CHLORIDE. Current Sci. 28 (3): 120-121. 1959. (Biological Abstracts)

GLOBUS, D. L., E. L. BECKER, and **D. D. THOMPSON.** (Dept. of Medicine, Cornell Univ. Med. College, New York City.)

RENAL EXCRETION OF INORGANIC SULFATE IN THE CHICKEN. Fed. Proc. 19 (1 Pt. 1): 369. 1960.—Abstract. (Biological Abstracts)

HILL, H. and **M. HAMED YOUSRY.** Beitrage zum Vitamin-E-Stoffwechsel. Die experimentelle Erzeugung einer E-Hypervitaminose beim Geflugel im Vergleich zur Wirkung von Epiphysenextrakten.

VITAMIN E METABOLISM. EXPERIMENTAL PRODUCTION OF VITAMIN E EXCESS IN POULTRY COMPARED WITH THE EFFECT OF PINEAL EXTRACTS. *Arch Tierernahrung*, 1960, 10, 129-141. (Physiol. Inst., Tierarztl. Hochsch., Hanover.)—In the first experiment, "Crossbreed" chicks, 3 weeks old, 9 male and 9 female, were fed to appetite on an ordinary diet and 7 of each sex had injections of DL-α-tocopheryl acetate, 100 mg. twice a week for 4 weeks and 200 mg. twice a week for 3 weeks, 2 g. in all. The others were untreated. In the second experiment, 7 male and 7 female White Leghorn chicks, 2

weeks old at the start, were fed normally to appetite and given subcutaneous injections of 1 ml. Glanepin, an extract of cattle pineal gland, twice weekly. A similar group had injections of Glanepin and DL-α-tocopheryl acetate, in all 20 ml. Glanepin and 3 g. tocopherol. A third group had no injection. Weekly bodyweights, size and weight of comb, testis and ovary at 10 weeks of age, and histological changes in testis are shown.

Weight gain was inhibited in both sexes by excess of tocopherol, and sex characters, both primary and secondary in the male, were poorly developed. The effect of tocopherol resembled that of pineal extract on the male sex characters, but pineal extract had no effect on weight gain. I. Leitch. (Nutrition Abstracts & Reviews

KLAIN, G. J., and B. CONNOR JOHNSON. (Dept. of Animal Science, Univ. of Illinois, Urbana.)
1, 2-C^{14}-AMINOETHANOL METABOLISM IN THE CHICK. Fed. Proc. 19(1 Pt. 1): 10. 1960.—Abstract. (Biological Abstracts)

KLEIN, J. RAYMOND. (Biology Dept., Brookhaven National Laboratory, Upton, N. Y.)
HEME SYNTHESIS BY DUCK ERYTHROCYTES AS A FUNCTION OF AGE. Fed. Proc. 19 (1 Pt. 1): 69. 1960.—Abstract. (Biological Abstracts)

KLIMA, MILAN. (Charles U., Prague, Czechoslovakia.) Prubeh vyvoje bursy Fabriciovy.
COURSE OF DEVELOPMENT OF THE BURSA FABRICII. (German summ.) Vest. Cesk. Spol. Zool. 21(4): 332-354. Illus. 1957.—The course of development of the bursa Fabricii and the thymus is described for: 163 Leghorn chickens with a small admixture of Rhode Island, 27 young laughing gulls [?] (*Larus ridibundus*), and 82 house sparrows (*Passer domesticus*). Observations are reported concerning changes in the histological structure of the bursa Fabricii during the course of its development. From a critical evaluation of the literature and from the results of this study, it is concluded that the bursa Fabricii can serve only as an approximate criterion in determining the age of a bird.—MDS. (Biological Abstracts)

KRAKOFF, I. H., C. R. LACON, and D. A. KARNOFSKY. (Sloan-Kettering Inst. for Cancer Research, New York, N. Y.)
TERATOGENIC URICOGENIC AND PROTECTIVE EFFECTS OF NICOTINAMIDE ANTAGONISTS AND SUBSTITUTES IN THE CHICK EMBRYO. *Fed. Proc.* 19(1 Pt. 1): 411, 1960.—Abstract. (Biological Abstracts)

KRAVIS, E. M. and M. R. KARE.
CHANGES WITH AGE IN TISSUE LEVELS OF SODIUM AND POTASSIUM IN THE FOWL. *Poultry Sci.*, 1960, 39, 13-15. (Dept. Physiol., New York State Vet. Coll., Cornell Univ., Ithaca.)—Na and K were estimated in brain, skin, muscle, liver and blood of White Leghorn chickens daily for 7 days from hatching and thereafter at intervals up to 463 days of age.

For the first 12 days there was great fluctuation and individual variability in values, Na in general decreasing and K increasing. Only at 3 to 4 weeks did values become more stable. Muscle showed the most striking changes with age in Na and K; at hatching the value for Na was 102, at 10 days 26 and at 35 days 16 m-equiv. per kg. fresh tissue and the corresponding values for K were 20, 113 and 92. There was no sex difference.—J. S. Thomson. (Nutrition Abstract & Reviews)

LACASSAGNE, L. (Sta. Rech. avicoles, Centre Natl. Rech. Zootechniques, Jouy-en-Josas, France.) Etude comparee des reserves vitellines et de la duree de la phase de grand accroissement de l'ovocyte chez la poule domestique. Influence de l'age de l'animal et de la longueur de la serie.

COMPARATIVE STUDY OF THE VITELLINE RESERVES AND THE DURATION OF THE PHASE OF RAPID GROWTH OF THE OVOCYTE IN THE DOMESTIC FOWL. INFLUENCE OF THE AGE OF THE ANIMAL AND THE LENGTH OF THE CLUTCH. (English summ.) *Ann. Inst. Natl. Rech. Agron. Ser. D - Ann. Zootech.* 9(1): 85-96. 1960.—This study was performed on 9 chickens divided into 2 groups according to age. The 1st group was 11 months old at the beginning of the experiment and 19.5 months old at the end, while the 2d group was 8 months old at the beginning and 13 months old at the end. The duration of the plase of rapid growth of the ovocyte was studied by means of a method in which liposoluble dyes are ingested. These dyes are deposited in the vitellus in concentric zones, permitting the reconstruction of the duration of evolution of the follicle in the course of the accumulation of its reserves once the egg is laid. From the results obtained it may be concluded that the lowering in intensity of laying during the 1st year of production correlating with an increase in weight of each of the ovocytes is due to a slower evolution of the follicle which is generally combined with a reduced vitellogenesis. The length of evolution of the rapid growth phase of the 1st follicle of a clutch is longer than that of the subsequent follicles. Evolution of the other ovocytes becomes progressively shorter as the end of the clutch approaches. The decrease in the amount of vitelline reserves per ovule in clutches of 2 eggs occurs in a similar manner. But in clutches of 3, 4, and 5 eggs these reserves increase or remain the same from the 1st to the 2d ovule and then dimish. These results demonstrate a correlation between the weigth of the vitellus and the length of its evolution.—MDS. (Biological Absracts)

LANSON, RAINO KULLERVO.

A STUDY OF THE INFLUENCE OF LIGHT AND DARKNESS UPON THE REPRODUCTIVE PERFORMANCE OF THE FOWL. Dissertation Absts. 20(11): 4426-4427. 1960.—Abstracts. (Biological Abstracts)

LAZZARINI, ABEL A., Jr. (New York U. Coll. Med., N. Y. C.)

IMMUNOLOGICAL EFFECTS OF MULTIPLE EXPERIMENTAL EMBRYONAL PARABIOSIS IN BIRDS. IN: FOURTH TISSUE HOMOTRANSPLANTATION CONFERENCE. *Ann. New York Acad. Sci.* 87(1): 133-139. Illus. 1960.—Multiple experimental parabiosis in chick embryos was effected by a modification of the method proposed by Hasek for single parabiotic pairs. The presence of blood exchange between the embryos was demonstrated during and after hatching. The amount of antibody production by reciprocal immunization in birds joined during embryonic life was proportional to their spatial relationship during incubation. When a single embryo was united to 3 or more parabionts, successful exchange of full-thickness skin grafts could be carried out, not only among members of the parabiotic teams, but also among unrelated homologous donors. Survival times of heterologous skin grafts were similar to those observed in control animals.—Auth. summ. (Biological Abstracts)

LOFLAND, H. B. and T. B. CLARKSON.

SERUM LIPOPROTEINS IN ATHEROSCLEROSIS-SUSCEPTIBLE AND RESISTANT PIGEONS. *Proc. Soc. Exp. Biol. Med.*, 1960, 103, 238-241. (Dept. Biochem., Bowman Gray Sch. Med., Wake Forest Coll., Winston-Salem, N.C.)—Total cholesterol, lipid phosphorus and total lipid were estimated in whole serum and in β-lipo-protein fractions of serum of White Carneau and Show Racer pigeons given commercial diets.

No significant differnece in β-lipoprotein values was found among males of the 2 breeds. In the serum from female birds total phospholipid and total lipid were much increased at the time of egg-laying. Serum cholesterol levels did not appear to change during the laying period but the proportion of cholesterol in the form of β-lipoprotein increased.—A. K. Lough. (Nutrition Abstracts & Reviews)

LYSOGOROV, N. V. and O. E. VYAZOV.
THE STUDY OF THE IMMUNOLOGY OF EMBRYOGENESIS. COMMUNICATION II. PHAGOCYTOSIS OF THE RED CELLS OF CHICK EMBRYOS BY LEUKOCYTES OF ADULT FOWLS. *Biull. Eksptl. Biol. i Med.* (Trans.) 48(12):1541-1543. Illus. 1959.—Phagocytosis of red cells in chick embryos was studied after 52 hours of incubation by the phagocytes of adult chickens. Experiments were conducted in vivo on the developing chick embryo to which fowl leukocytes were added, as well as in vitro, by mixing the red cells obtained from the embryo with the fowl leukocytes. The experiments demonstrated that fowl phagocytes behave with chick embryo red cells as with foreign cells, by effecting the initial stages of phagocytosis.—Auth. summ. (Biological Abstracts)

MANDELES. S.
USE OF DEAE-CELLULOSE IN THE SEPARATION OF PROTEINS FROM EGG WHITE AND OTHER BIOLOGICAL MATERIALS. *J. Chromatography*, 1960, 3, 256-264. (W. Reg. Res. Lab., U.S. Dept. Agric., Albany, Calif.) (Nutrition Abstracts & Reviews)

MANOCHA, SOHAN LALL. (Panjab U., Hoshiarpur, India.)
MORPHOLOGICAL AND CYTOCHEMICAL STUDIES ON THE AGEING SPINAL NUERONES OF THE DOMESTIC FOWL. GALLUS DOMESTICUS. *Res. Bull. Panjab Univ. Sci.* 10(3/4): 343-356. Illus. 1959.—Three types of cytoplasmic inclusions observed in the spinal neurones of ageing fowls, studied morphologically and cytochemically, are: (1) mitochondria, (2) lipid bodies of four kinds (L_1, L_2, L_3, and L_4,) and (3) Nissl substance. The mitrochondria are granular, or rod-like, or in the form of curved filaments. The smaller L_1 bodies consist of lipoproteins, and the larger of phospholipids. The L_2 bodies show a duplex structure (crescents and rings), this has been proved to be a fixation artifact. Histochemically the L_2 bodies are a mixture of phospholipids and triglycerides. The L_3 bodies consist of triglycerides only. The L_4 bodies (mulberry spheroids) have phospholipid 'satellite' granules and, in addition, traces of triglycerides in their cortices; their cores have some pigment which does not react to any histochemical test.Axonal aggregations of the lipid bodies have been observed only in the aged neurones. The Nissl substance, which is rich in RNA, is in the form of elongate and irregular bodies. Finally there are some neurofibrillae and vacuoles, whose true nature it is difficult to ascertain.—Author. (Biological Abstracts)

MASAHITO, PRINCE, and TAKASHI FUJII.
HISTOLOGY OF PIGEON CROP-SAC, WITH SPECIAL REFERENCE TO EARLY CHANGES EVOKED BY PROLACTIN. *Jour. Fac. Sci. Tokyo Univ. Sect. IV. Zool.* 8(3): 401-409. Illus. 1959.—The earliest characteristic change in the crop-sac following the prolactin injection is the appearance of numerous downgrowths at the base of the germinal layers of the epithelium, with some addition to the connective tissue and congestion of blood vessels in the tunica propria. However, development of large folds of thickened mucosa cannot in itself be taken as true hypertrophy by prolactin; the formation of numerous parallel strands on the crop is also deceptive, for such strands not infrequently occur normally on the inner crop walls in the untreated (unmated) birds. The immediate changes appeared in the isolated piece of the crop-sac after prolactin treatment in vitro are essentially the same as those in vivo conditions. On the experimental basis the authors do not agree with the current view, including Litwer's, but emphasize the importance of the earlier work by Charbonnels-Salle and Phisalix (1886), at least as to the early effect of prolactin. On the 2d and 3d day after hatching of the young, the glands of Teichmann become greatly hypertrophic and active; contrary to the general belief, these glands might play an important part in the pigeon milk formation.—From auth. summ. (Biological Abstracts)

MATSUMURA, Y. (Dept. of Poultry Husbandry, Univ. of Calif., Berkeley, Calif.)
THE TRYPTOPHAN METABOLISM OF CHICKENS. *Fed. Proc.* 19(1 Pt. 1): 8. 1960.—Abstracts. (Biological Abstracts)

McNARY, H. W., A. E. BELL, and **C. H. MOORE.** (Purdue U., Lafayette, Indiana.)
THE GROWTH OF INBRED AND HYBRID CHICKEN EMBRYOS. *Poultry Sci.*, 39(2): 378-384. 1960.—Embryo growth was measured for 2 inbred lines of the S. C. White Leghorn Breed. 1 inbred line of Rhode Island Reds, 1 inbred line of New Hampshire and all their crosses including reciprocals. Growth measurements taken were: somite number after 38 hours of incubation, weight after 1 week of incubation, and weight after 2 weeks of incubation. Genetic differences in embryonic growth were observed at all 3 stages. Heterosis was also present at all stages, but the effect was obscurred partially by a maternal growthh depressent transmitted by 1 line. Embryos from the heavy breeds were consistently heavier than those from the Leghorn lines.—H. W. McNary. (Biological Abstracts)

MUNSICK, ROBERT A., WILBUR H. SAWYER, and **H. B. VAN DYKE.** (Columbia U. Coll. Physicians and Surg., N. Y. C.)
AVIAN NEUROHYPOPHYSIAL HORMONES: PHARMACOLOGICAL PROPERTIES AND TENTATIVE IDENTIFICATION. *Endocrinology* 66(6): 860-871. 1960.—The pattern of pharmacological activities in the chicken neurohypophysis has been studied and described. These activities correspond to those of a mixture of oxytocin and arginine vasotocin, an analogue of oxytocin synthesized by Katsoyannis and du Vigneaud. Paper chromatographic and enzymatic studies, together with the demonstration of inactivation by thioglycollate, furnish additional evidence suggesting that oxytocin and arginine vasotocin may be neurohypophysial hormones in the chicken, *Gallus domesticus*.—Auth. abst. (Biological Abstracts)

MURAKAMI, RYOKO, MASAYUKI WATABE, SYOJI ITAGAKI, and **TETUZO KONDO.** (Hirosaki U., Japan.)
COMPARATIVE ANATOMY OF BONY LABYRINTH OF MELEAGRIS GALLOPAVO. (In Japanese with English summ. p. 56-57.) *Hirosaki Med. Jour.* 11(2): 370-384. Illus. 1960.—One hundred and fourteen cast preparations of the bony labyrinths from 58 *Meleagris gallopavo* (30 male and 28 female) were observed morphologically and the dimensions of the lagena, vestibule and semicircular canal were measured by the same method as with *Gallus* (Watabe '60). There were 29 female and 26 male pairs. The results obtained are as follows: The data show mean values. In the bony labyrinth of female and male, the capacity correlates with the length. The pars auditiva (lagena) in the bony labyrinth is smaller than the pars statica as seen in *Gallus gallus domesticus*. The lagena is short and tubular with an elliptically expanded head. The lagena of *Meleagris* is larger than that of *Gallus*. The form of the vestibule of *Meleagris* is the same as in *Gallus*. The crus ampullare of the posterior semicircular canal continues to the sinus utriculi posterior (Wiedersheim 1909) as in *Gallus*. The intersection of the lateral and posterior semicircular canals is the same as in *Gallus*. The circles of the semicircular canals are elliptical. The anterior canal is most elliptical of the 3 canals. The ratio of the longest length in the anterior posterior and lateral semicircular canals is about 6: 4: 5, the same value as in *Gallus*. The internal diameters of the semicircular canals are smaller than those of *Gallus*. The diameter of the ampulla is twice as large as that of the semicircular canal. The ampulla is not as expanded as in mammals, but larger than in *Gallus*. The crus commune is short and slender, but is relatively larger in *Meleagris* than in *Gallus*. The bony labyrinth of the male is larger than that of the female. The form of the bony labyrinth is very similar in Meleagris and Gallus. The bony labryinth of *Meleagris* are on the whole larger than those of *Gallus*, but the inner diameter of the semicircular canal in *Meleagris* is smaller than in *Gallus*.—Auth. summ. (Biological Abstracts)

NEUMANN, H., and M. SELA. (Weizmann Inst. Sci., Rehovot, Israel.)
PROTEOLYTIC ACTIVITY IN EGG WHITE. *Bull. Res. Counc. Israel Sect. A. Chem.* 9A(1/2): 103-104.. 1960.—Abstract. (Biolgoical Abstracts)

ORLOFF, JACK, and MAURICE BURG. (Natl. Heart Inst., Bethesda, Md.)
EFFECT OF STROPHANTHIDIN ON ELECTROLYTE EXCRETION IN THE CHICKEN. *Amer. Jour. Physiol.* 199(1): 1960.—Strophanthidin, a cardiac aglycone, interferes with Na+, K+ and H+ ion transport by the renal tubule cells of the chicken. Injection of 250-500 μg/min. of the aglycone into the renal-portal circulation results in a predominantly unilateral increase in Na+ excretion and alkalinization of the urine. K+ excretion diminishes if initially elevated by prior administration of KCl or K_2SO_4. The concordant changes in K+ and H+ ion secretion associated with depressed reabsorption of Na+ are in contrast to reciprocal alterations in K+ and H+ ion transport observed with carbonic anhydrase inhibitors. The data have been interpreted as indicating that the aglycone inhibits a contraluminal Na+, K+ exchange pump (analogous to that in other tissues) and that the urinary changes are secondary to this and not a consequence of a primary reduction in the capacity of a linked Na+, K+, H+ ion exchanger on the luminal border.—Authors. (Biological Abstracts)

PEREK, M. and A. EILAT. (Hebrew U., Fac. Agric., Rehovot, Israel.)
THE BURSA OF FABRICIUS AND ADRENAL ASCORBIC ACID DEPLETION FOLLOWING ACTH INJECTIONS IN CHICKS. Jour. *Endocrinol*, 20(3): 251-255, 1960.—Injections of fast-acting or prolonged-acting ACTH in 6-week-old and 3-week-old chicks, when the bursa of Fabricius had been removed, resulted in a depletion of their adrenal ascorbic acid (AA). Following administration of fast-acting ACTH in 6-week-old and 3-week-old bursectomized birds, the adrenal AA concentration declined by 45.8 and 37.8% respectively, as compared with saline-treated control groups. There was no significant depletion of the total content or the concentration of AA in the adrenal glands of the bursa-intact birds treated in the same manner. The adrenal AA concentration of 6-week-old and 3-week-old bursectomized birds treated with prolonged-acting ACTH was lowered by 45.8 and 25.9% respectively. Intact birds, similarly treated, showed a slight decrease in their adrenal AA concentration of no significant value. A single injection of fast-acting ACTH in 6-week-old and 3-week-old bursa-intact birds had no significant effect on the weight of the bursa or on its total content or on the concentration of AA, as compared with the saline-treated controls. Prolonged-acting ACTH injections in both 6-week- and 3-week-old bursa-intact groups caused an involution of the bursa by 29.4 and 52.6% respectively. The total AA content of the bursa was reduced proportionately by 29.0 and 57.0%, while the AA concentration remained within normal limits. The results of the experiments indicate that the bursa of Fabricius is involved in preventing the release of adrenal AA following ACTH treatment.—M. Perek. (Biological Abstracts)

PETERS, J. J., A. R. VONDERAHE, and A. A. HUESMAN. (Xavier U., Cincinnati, Ohio.)
CHRONOLOGICAL DEVELOPMENT OF ELECTRICAL ACTIVITY IN THE OPTIC LOBES, CEREBELLUM, AND CEREBRUM OF THE CHICK EMBRYO. *Physiol. Zool.* 33(3): 225-231. 1960.—The cerebrum, optic lobes, and cerebellum of the chick embryo are electrically silent until about the 13th day of incubation, at which time the cerebral lobes begin to emit electrical waves of slow frequency and small amplitude. On about the 15th day of incubation, the optic lobes and cerebellum begin to show sopntaneous discharges of small amplitude and a frequency of about 10 to 14 waves/second. With increasing age, the amplitude of these electrical discharges also increases. At the time of hatching the pattern of electrical activity exhibited by either the cerebrum or the optic lobes, or cerebellum is distinctive. Modifications of the electro-encephalographic record by such artifacts as gross movements,

muscle potentials, respiration, chirping, and twitches of eye muscles are described and illustrated. The discussion deals with the correlations between changes in electrical activity and embryological development of the chick brain.—Authors. (Biological Abstracts)

PLACK, P. A.

VITAMIN A_1 ALDEHYDE IN HEN'S EGGS. *Nature*, 1960, 186, 234-235. (Nat. Inst. Res. Dairying, Univ. Reading.)—When egg yolk was analysed as previously described (Abst. 5344, Vol. 29) for fish eggs, vitamin A_1 aldehyde was not detected by the Carr Price reaction or by ultraviolet absorption. But when the appropriate fractions were reduced with sodium borohydride and chromatographed by the method of Kon *et al.* (Abst. 312, Vol. 26), vitamin A_1 alcohol was detected by the Carr Price test and was assumed to be derived from vitamin A_1 aldehyde, calculated to amount to abount 11 μg. per yolk. The eggs were fertile, from Light Sussex hens fed on a mash with 2.4 mg. pre-formed vitamin A per kg.

Freeze-dried yolk was extracted with ether and the residue with ethanol and then repeatedly with light petroleum; the extracts were evaporated and the residues dissolved in *n*-hexane for estimation of vitamin A_1 esters, alcohol and aldehyde. The ether extract was found to contain 95 per cent. of the total free and estrified vitamin A_1, but no vitamin A_1 aldehyde. The light petroleum extract contained vitamin A_1 aldehyde in amount corresponding to about 20 μg. per egg. No vitamin A_2 aldehyde was detected.

No vitamin A in any form was found in egg white. As was reported by Neff *et al.* (Abst. 3289, Vol. 19), vitamin A_1 alcohol predominated, with about 100 μg. per egg; the amount of vitamin A_1 esters was about the same as that of vitamin A_1 aldehyde.—W. M. Deans. (Nutrition Abstracts & Reviews)

RASPET, AUGUST.

BIOPHYSICS OF BIRD FLIGHT. THE VERY LOW DRAG OF NATURE'S AIRCRAFT, BIRDS, SETS A GOAL FOR MAN IN HIS STRIVING FOR EFFICIENT AIRCRAFT. *Science* 132(3421): 191-200. Illus. 1960. (Biological Abstracts)

RENNICK, B. R.

RENAL TUBULAR EXCRETION OF RIBOFLAVIN IN THE CHICKEN. *Proc... Soc. Exp. Biol. Med.*, 1960, 103, 241-243. (Dept. Physiol., State Univ. New York, Syracuse.)—Riboflavin, from 0.06 to 0.24 mol. per min., was infused into the renal portal circulation of one kidney of chickens via the saphenous vein. Urine was collected separately from the ureters. Simultaneous infusion of *p*-aminohippuric acid (PAH) gave a measure of the amount of blood and hence of the injected compound which by-passed the kidney to enter the systemic circulation. The apparent tubular excretory fraction of riboflavin was 24, of PAH 62. To determine the transport system used by riboflavin, competitve inhibitors of organic acid and base transport systems were used. Benemid inhibited excretion of both PAH and riboflavin; tolazoline inhibited only riboaflvin. It was concluded that excretion of riboflavin was by the transport system of organic bases.—J. Hammant. (Nutrition Abstracts & Reviews)

REYNIERS, J. A., M. WAGNER, T. D. LUCKEY, and **H. A. GORDON.**
(Lobund Inst., U. Notre Dame, Ind.)

THE WHITE WYANDOTTE BANTAM AND WHITE LEGHORN CHICKEN. *Lobund Repts.* 3, 7-171. Illus. 1960. (Biological Abstracts)

RHODES, MARVIN B., NELLE BENNETT, and **ROBERT E. FEENEY.**
U. Nebraska, Lincoln.)

THE TRYPSIN AND CHYMOTRYPSIN INHIBITORS FROM AVIAN EGG WHITES. *Jour. Biol. Chem.* 235(6): 1686-1693. 1960.—The ovomucoids from 11 different avian species were isolated and studied in detail. The ovomucoids were all somewhat similar as to the conditions for elution from carboxymethyl cellulose, low nitrogen con-

tent, and the low content or absence of trytophan. Minor differences were found such as varying contents of sialic acid. Extensive differences, however, were found in the biological activities. The types of biological activity of the ovomucoids may be divided into 4 classes on the basis of their inhibitory activity against synthetic substrates and casein: (1) ovomucoids which inhibit primarily trypsin; (2) ovomucoids which inhibit primarily chymotrypsin; (3) ovomucoids which inhibit equal molar amounts of trypsin and chymotrysin, separately or simultaneously; and (4) ovomucoids which inhibit twice as much trypsin as chymotrypsin, separately or simultaneously. The latter 2 classes of inhibitors were considered to be "multiheaded" in their biological action. Differences in inhibitory activity were noted with different substrates. Ultracentrifugal and electrophoretic studies on mixtures of the inhibitors and the enzymes showed the formation of complexes. The calculated ovomucoid contents of 8 avian egg whites of different species are given.—R. E. Feeney. (Biological Abstracts)

RICHERT, DAN A., BURNETT Q. PIXLEY, and **MARTIN P. SCHULMAN.** (State U. New York, Syracuse.)

ERYTHROPOIESIS IN DUCKS WITH VARIOUS B-VITAMIN DEFICIENCIES. *Jour. Nutrition* 71(3): 289-295. 1960.—Phenylhydrazine was administered in ducklings deficient in niacin, riboflavin, thiamine, pantothenic acid or vitamin B_6 as well as to control ducklings. Both the deficient and control ducks responded to the drug by producing increased percentages of immature red cells in the peripheral blood. The phenylhydrazine treatment produced lower blood hemoglobin concentrations in the vitamin-deficient ducks than in the controls. This could be accounted for primarily by the presence of fewer total red cells in the deficient animals; the mean corpuscular volumes and mean corpuscular hemoglobin concentrations were comparable in both groups treated with phenylhydrazine, except in vitamin B_6 deficiency where the cells were microcytic. The red cells obtained from phenylhydrazine-treated control and deficient ducks showed comparable rates of heme synthesis in vitro from glycine-2-C^{14} except in vitamin B_6 deficiency. In this deficiency heme synthesis was increased to about one third of the control level, but addition of phyridoxal-5,-phosphate to the deficient cells restored heme synthesis to control values.—Author. (Biological Abstracts)

RIGDON, R. H. (U. Texas Med. Br., Galveston.)

AMYLOIDOSIS—EXPERIMENTAL PRODUCTION IN DUCKS WITH METHYLCHOLANTHRENE. *Texas Repts. Biol. and Med.* 18(1): 93-102. Illus. 1960.—Amyloid frequently occurs in the liver, spleen and adrenals of white Pekin ducks receiving the carcinogenic agent, methylcholanthrene. The anatomic location and the staining reactions of the amyloid are similar to that observed in man. The amyloid in the liver of the duck is closely associated with the reticulum. The frequency of the occurrence of amyloid in a group of ducks and the amount present in the viscera are not related to the quantity of methylcholanthrene given. The amyloid occurring in these ducks resembles the so-called primary amyloidosis of man. Since amyloid has been observed recently in ducks given only polysorbate, the pathogenesis of this lesion is now being studied.—R. H. Rigdon. (Biological Abstracts)

ROY, DWIJENDRA NATH.

TOXICITY AND METABOLISM OF BETA-AMINOPROPIONITRILE AND RELATED COMPOUNDS IN CHICKS, TURKEYS AND RATS. Dissertation Absts. 20(11): 4264. 1960.—Abstract. (Biological Abstracts)

RUSSO-CAIA, S. (U. Rome, Italy.) Osservazioni sull'attivita proteinasica e sugli aminoacidi e peptidi liberi nello sviluppo embrionale del cuore e del fegato del pollo.

OBSERVATIONS ON THE PROTEINASE ACTIVITY AND ON THE FREE AMINO ACIDS AND PEPTIDES IN THE EMBRYONAL DEVELOPMENT FOR THE HEART AND LIVER OF CHICKEN.

Ricerca Sci. 30(1): 148-157. 1960.—The author investigated (by the Duspiva method) the behavior of proteinase activity (using casein as a substrate at pH 5) during embryonal development in the heart and liver of chicken. The enzymatic activity increases in both organs as from the 1st stage considered (7 1/2 days) until hatching and after; the increase is slight in the heart (100% in the 7 1/2 day, 140% in the 10 day chicken) and very appreciable in the liver (100% in the 7 1/2 day, 612 in the 10 day chicken.) The free ninhydrine-positive substances (amino acids, dipeptides and some tripeptides), which were investigated quantitatively with the Moore and Stein method, increased in the heart as from the 4th day (100%) to the 16th day (174%) and remained then almost unvaried, while in the liver an increase from the 4th day (100%) to the 9-10th day (217%) is followed by a reduction at the moment of hatching. The significance of these data is considered in relation to (a) the role of the proteolytic enzymes in the phenomena of growth and morphogenesis; (b) the protein metabolism in bird embryos; (c) the phenomena of differentiation of the individual organs during embryonal development.—Auth. summ. (Biological Abstracts)

SAHA, ANIL. (California Inst. Technol., Pasadena.)
IN VITRO BIOSYNTHESIS OF CHICK HEMOGLOBINS. *Biochem. and Biophys. Res. Communications* 2(6): 450-454. 1960. (Biological Abstracts)

SALMI, A., U. K. VIRTANEN and E. KULONEN.
NUCLEOTIDES AND AMINO ACIDS OF THE LATHYRITIC CHICK EMBRYOS. *Ann. Med. exp. Biol. Fenn.*, 1960, 38, 35-38. (Dept. Med. Chem., Univ. Turku.)—Eggs, in groups of 20 to 30, were incubated and after 8 days 0.314 mg. β-aminopropionitrile sulphate in 0.075 ml. water was injected into the yolksac. Control eggs received water only. After 12 days the embryos were homogenised; the supernatant fraciton was neutralised and the new supernatant was fractionated by the method of Hurlbert *et al. (J. Biol. Chem.*, 1954, 209, 23) and examined spectrophotometrically. Amino acids were obtained from the homogenate by precipitation with ethanol and solution in acid acetone; they were examined on two-dimensional chromatograms.

No differnece was found in free nucleotides or amino acids between treated and untreated groups of embryos, suggsting that lathyrism does not have a primary effect on nucleotide metabolism.—V. R. Jackson. (Nutrition Abstracts & Reviews)

SCHILLER, SARA. (U. Chicago, Ill.)
MUCOPOLYSACCHARIDES OF THE ESTROGEN-STIMULATED CHICK OVIDUCT. *Biochem. et Biophys. Acta* 32(2): 315-319. 1959.—Hyaluronic acid, heparin monosulfuric acid and a mixture of chondroitinsulfric acid-A and -B have been isolated from the oviducts of stilbestrol-injected chicks.—Auth. summ. (Biological Abstracts)

SIBBALD, I. R. and L. M. HUTCHESON.
THE CONVERSION OF β-CAROTENE TO VITAMIN A *IN VIVO*. 1. THE TIME REQUIRED FOR CONVERSION TO TAKE PLACE. 2. A DEMRONSTRATION OF THE EXISTENCE OF AN INTERMEDIARY PRODUCT(S). Poultry Sci., 1960, 39, 99-103. (Dept. Nutrit., Ontario Agric. Coll., Guelph.)—For previous work see Absts. 5359, Vol. 29; 256, Vol. 30.—When β-carotene was injected into tied duodenal loops of live chicks depleted of vitamin A, the time taken for vitamin A to appear in the duodenal wall ranged from less than 5 min. to almost an hour. Preliminary results showed that the amount of β-carotene required to produce 1 I.U. vitamin A decreased as the amount of vitamin A produced increased. From results of a more extensive experiment with 257 chicks a linear regression equation was obtained between the carotene conversion ratio and the reciprocal of the amount of vitamin A produced, from which it was calculated that the minimum amount of β-carotene required to produce 1 I.U. vitamin A was 0.383 ±

0.685 μg. The form of the relationship is evidence in favour of the existence of an intermediary product in the conversion.W. M. Deans. (Nutrition Abstracts & Reviews)

SINHA, D. (U. Calcutta, India), **IRA RAY,** and **A. GHOSH.**
THE INFLUENCE OF SEX AND MATURITY ON THE HISTOLOGIC STRUCTURE OF SUPRA-RENAL GLANDS OF THE PIGEON. *Nucleus* 2(2): 171-178. 1959.—Some histological differences in adrenal glands from juvenile (20-30 days) and adult (90-100 days) male and female common Indian domestic pigeons are described. The probable significance of some intracapsular structures as well as the problems involving cytomorphism, nuclear polarity, cytogenesis and pigmentation in the interrenal tissue is briefly discussed.—W. Ferris. (Biological Abstracts)

SQUIBB, ROBERT L. (Rutgers, State U., New Brunswick, N. J.)
RELATION OF DIURNAL TEMPERATURE AND HUMIDITY RANGES TO EGG PRODUCTION AND FEED EFFICIENCY OF NEW HAMPSHIRE HENS. *Jour. Agric. Sci.* 52(2): 217-222. Illus. 1959.—The effect of environment on production and size of eggs, feed efficiency and mortality of hens in individual cages located simultaneously in 5 areas of Guatemala having temperature range of 0-45° C showed that while the birds did exhibit visible signs of thermo-stress, there were no aprpeciable differences in egg size, production, feed consumption, mortality and body weight between areas or between groups within areas. The inconsistency of these data with other published reports is assumed to be due to the wide diurnal range for temperature and humidities. As a working hypothesis, the diurnal temperature range is related to the fowl's tolerance to thermo-stress.—V. Raghavan. (Biological Abstracts)

STURKIE, PAUL D., and **KURT TEXTOR.** (Rutgers U., New Brunswick, New Jersey.)
FURTHER STUDIES ON SEDIMENTATION RATE OF ERYTHROCYTES IN CHICKENS. *Poult. Sci.,* 39(2):444-447. 1960.—This study deals with the relationship of lipids, proteins and specific gravity of plasma, and the number and volume of erythrocytes to sedimentation rate in adult males, capons and females. Sedimentation rates were determined on blood in Wintrobe tubes, held at a 45° angle and at 80° F. Sedimentation rate was highest in females, intermediate in capons and lowest in males. Hematocrits and numbers of cells were highest in males, intermediate in capons and lowest in females. Mean corpuscular volume was not different in females and capons but was significantly greater in males. Evidence is presented which indicates that hematocrit and cell numbers influence sedimentation most and cell size to a much lesser degree. The specific gravity of the plasma of females was some lower than males, but differences in gravity show little influence on settling rate. Sedimentation rate is increased in birds fed high levels of Nicarbazin. Plasma specific gravity is not a good measure of plasma proteins in laying birds.—P. D. Sturkie. (Biological Abstracts)

SUZUKI, SAKARU, and **JACK L. STROMINGER.** (Washington U. Sch. Med., St. Louis, Mo.)
ENZYMIC SYNTHESIS OF SULFATED MUCOPOLYSACCHARIDES IN HEN OVIDUCT. *Biochem. et Biophys. Acta* 31(1): 283-285. 1959. (Biological Abstracts)

SYKES, A. H.
A NOTE ON THE DETERMINATION OF OXYGEN IN THE BLOOD OF THE FOWL. *Poultry Sci.,* 1960, 39, 16-17. (Dept. Vet. Physiol., Univ. Liverpool.)—Oxygen could be estimated in fowl blood by Van Slyke's method with dilute reagents if the NaOH and hyposulphite were in turn run in slowly to form a layer on top of the blood mixture. The percentage saturation of arterial and mixed venous blood was 56.5 and 22.4 for the hen, 78.0 and 56.5 for the cock.—A. Hepburn. (Nutrition Abstracts & Reviews)

TAGWERKER. F. Die Rolle des Vitamin C in der Physiologie und Ernahrung des Geflugels.

THE ROLE OF VITAMIN C IN THE PHYSIOLOGY AND NUTRITION OF POULTRY. *Arch. Geflugelk.*, 1960, 24, 160-205. English summary.—A review with 185 references. (Nutrition Abstracts & Reviews)

TANABE, Y. and F. H. WILCOX.

EFFECTS OF AGE, SEX AND LINE ON SERUM ALKALINE PHOSPHATASE OF THE CHICKEN. *Proc. Soc. Exp. Biol. Med.*, 1960, 103, 68-70. (Dept. Poultry Husb., Univ. Maryland ,College Park.)—Serum alkaline phosphatase was estimated by the method of Bessey *et al.* (Abst. 2569, Vol. 16) and expressed as m-moles nitrophenol liberated per litre serum per hr. Values were estimated for a line of chickens bred for high alkaline phosphatase and for a random population. In both lines they were sometimes higher in pullet than in male chicks up to 14 weeks of age but thereafter were regularly higher in the cockerels. They rose to a peak at 2 to 3 weeks of age and then declined to very low values by 34 weeks. Between 2 and 26 weeks they were consistently higher in the specially selected line, means at 2 weeks 589 and 439 units in males and females, respectively, against 350 and 282 in the unselected.—D. Duncan. (Nutrition Abstracts & Reviews)

TAYLOR, T. G., J. H. MOORE and F. HERTELENDY.

VARIATIONS IN THE MINERAL COMPOSITION OF INDIVIDUAL BONES OF THE SKELTON OF THE DOMESTIC FOWL. *Brit. J. Nutrition*, 1960, 14, 49-57. (Dept. Physiol Chem., Univ. Reading.)—The mineral contents of 15 bones from each of 5 pullets were studied. Two of the birds were killed before the pre-laying storage of bone had taken place, one after pre-laying storage but before the first egg was laid, one after laying 3 eggs on a normal diet and one after laying 6 eggs on a low-calcium diet.

The bones fell into groups according to their citric acid content. The values for one group were all greater than 2 per cent. of the calculated ash and for the other all less than 2 per cent. Bones high in citric acid were ribs, sternum, skull, toes, ilium and ischium; the highest mean was 2.59 for the sternum and the lowest was 2.29 for the ribs. Bones low in citric acid were wing and leg bones, coracoid, scapula and cervical vertebrae; the highest mean was 1.89 for cervical vertebrae and the lowest was 1.44 for femur.

There was a tendency for bones rich in citric acid to be rich also in K and there was a significant inverse relation between citrate and carbonate contents. The onset of reproductive activity was associated with increases in Na and carbonate and decreases in Mg and phosphate. No change in bone citric acid was found although plasma citric acid fell from 8.3 to 2.8 mg. per 100 ml. as reproductive activity approached. R. Hill. (Nutrition Abstracts & Reviews)

URIST, M. R. and N. M. DEUTSCH.

OSTEOPOROSIS IN THE LAYING HEN. *Endocrinology*, 1960, 66, 377-391. (Dept. Surg., Sch. Med., Univ. California, Los Angeles.)—Osteoporosis develops in White Leghorn pullets during the first year of egg production; it becomes severe during moulting. Immature and young mature pullets, cockerels and non-moulting cocks do not show osteoporosis. Mature pullets in heavy lay, compared with immature pullets, cockerels, and post-moult yearling cocks, showed hypertrophy of all endocrine organs. The ovaries, including ova storing yellow egg yolk, weighed 34 to 44 g. compared with 1 to 5 g. in yearling resting hens. Serum Ca ranged from 12.7 to 35.5 mg. per cent., against 7.6 to 11.0 in resting hens. Ultrafilterable Ca showed little change. The cortex of the tibia was half the thickness of that of immature birds.

Endocrine changes associated with avian osteoporosis are: atrophy of the adrenal cortex, decrease in size and weight of the gonads, some diminution in the weight of the thyroids and parathyroids. The outstanding feature is the decrease in thickness of bone cortex. The com-

pact bone is more porous the cortical bone is resorbed from within so that the marrow cavity becomes larger, and the Haversian canals are enlarged without osteoclast formation. The bones are fully calcified, and may be even hypercalcified, hard and brittle. It is stated that a low Ca intake is associated with diverse endocrine reactions and a calcium-deficient diet is of itself not sufficient to produce osteoporosis. The effect of oestrogen treatment in the hen includes hyprcalcaemia, 66.2 to 120.4 mg. per cent., reduction in thickness of the cortex of tibia and femur, and marrow cavity occluded with intramedullary bone. Erosion of the cortex and deposition of spongy bone produced porous, brittle bones which were easily fractured and slow to repair.—E. W. H. Cruickshank. (Nutrition Abstracts & Reviews)

URIST, MARSHALL R., and **NANCY MARIE DEUTSCH.** (U. California, Los Angeles.)
EFFECTS OF CORTISONE UPON BLOOD, ADRENAL CORTEX, GONADS, AND THE DEVELOPMENT OF OSTEOPOROSIS IN BIRDS. Endocrinology 66(6): 805-818. Illus. 1960.—Domestic birds exhibited a high tolerance for massive doses of cortisone and developed osteoporosis that was very slight in the rooster, moderately severe in the capon, and severely destructive in the hen. After four weeks of treatment, the adrenals and gonads were atrophied, and there was hypercalcemia, associated with an elevation in the ultrafilterable fraction of the serum calcium. Egg production generally ceased within one week, but a few birds continued to lay irregularly, or briefly, and produced shell-less dwarf eggs with a membranous stalk. Bone was resorbed from the endosteal surface of the cortex of the skeleton by means of a local mechanism that did not require formation of osteoclasts. Estrogen injected into cortisone-treated birds produced the phosphoproteinemia, phospholipidemia, and lipema (associated with twenty-fold rise in the non-ultrafilterable fraction of the serum calcium), the same as in normal birds. Estrogen, without androgen, did not give the hen protection against osteoporosis. The rooster was relatively resistant to osteoporosis. Auth. abst. (Biological Abstracts)

VOGEL, WOLFGANG, DAN A. RICHERT, BURNETT Q. PIXLEY, and **MARTIN P. SCHULMAN.** (State U. New York, Syracuse.)
HEME SYNTHESIS IN IRON-DEFICIENT DUCK BLOOD. Jour. Biol. Chem. 235 (6): 1769-1775. Illus. 1960.—The rate of heme synthesis in vitro from glycine-2-C^{14} or from α-aminolevulinic acid-2, 3-C^{14} by the red blood cells from iron-deficient duckling was lower than that observed with normal ducks. Less free protoporphyrin accumulated from glycine but not from α-aminolevulinic acid substrate. Less α-aminolevulinic acid was synthesized from glycine by the insoluble particulate fractions prepared from iron-deficient red cells than from control cells. Therefore, it appeared that iron deficiency had two effects on heme synthesis. It decreased the rate of synthesis of α-aminolevuline acid from glycine and of heme from protoporphyin.—Authors. (Biological Abstracts)

VOHRA, P. and **F. H. KRATZER.**
ISOLATION OF RADIOACTIVE VITAMIN B_{12} FROM INCUBATION MIXTURES CONTAINING GLYCINE-2-^{14}C AND TURKEY LIVER HOMOGENATES. *Nature*, 1960, 185, 45-47. (Dept. Poultry Husb., Univ. California, Davis.) For previous work see Abst. 378, Vol. 27.—Labelled formaldehyde was isolated as formaldemethone when glycine-2-^{14}C or serine-3-^{14}C, but not when glycine-1-^{14}C, was incubated with liver homogenates from turkey poults deprived of vitamin B_{12}. In presence of vitamin B_{12} the activity was slightly greater and complexes of formaldehyde and vitamin B_{12} were found; labelled vitamin B_{12} also was found except when glycine-1-^{14}C was used.—A. Hepburn. (Nutrition Abstracts & Reviews)

WATABE, MASAYUKI. (Hirosaki U., Japan.)
COMPARATIVE ANATOMY OF BONY LABYRINTH OF GALLUS GALLUS DOMESTICUS. (In Japanese with English summ. p. 49.) Hirosaki Med. Jour. 11(2): 320-334. Illus. 1960.—One hundred and twelve

cast preparations of the bony labyrinth from 60 *Gallus gallus domesticus* (32 male and 28 female) were observed morphologically and the dimensions of the lagena, vestibule and semicircular canal were measured. There were 27 female and 25 male pairs. The results obtained are as follows. The data show mean values. In the bony labyrinth of females, the capacity correlates with the largest length but not with the axial length. In the bony labyrinth of males, the capacity correlates with the axial length but not with the largest length. The pars auditiva (lagena) is smaller than the pars statica in the bony labyrinth. The percentage of the pars auditiva in the labyrinth of *Gallus* is smaller than that of mammals. The lagena is short and tubular with a slightly expanded head. In the vestibule, recessus utriculi is tubular and recessus sacculi is globular. The crus ampullare of the posterior semicircular canal continues to the sinus utriculi posterior (Wiedersheim 1909) and its sinus opens into the recessus utriculi. The intersection of the lateral and posterior semicircular canals are moderately close. At the point of this intersection, both canals firmly come into contact with each other and the lateral semicircular canal is bent. The circles of the semicircular canals are elliptical. The anterior canal is the most elliptical of the 3 canals. The diameter of the ampulla is about twice as large as that of the semicircular canal. The ampulla of *Gallus* is not as expanded as in mammals. The crus commune of *Gallus* is shorter and more slender compared with that of mammals. The data mentioned above demonstrate that the bony labyrinths of males are larger than those of females. However, the largeness of the circle of the semicircular canal is very similar in both sexes.—Auth. summ. (Biological Abstracts)

WATANABE, MITSUO. (Showa Med. Sch., Tokyo, Japan.)
INFLUENCE OF VITAMIN B_1 AND THIAMINE PROPYLDISULFIDE ON THE LIVER OF CHICK EMBRYO. (In Japanese with English summ. p. 54.) Folia Pharmacol. Japonica 55(6): 1485-1504. Illus. 1959—Vitamin B_1 and thiamine propyldisulfide administered to White Leghorn embryos caused degenerative changes in the liver of the chick embryos, though slight. From the result of continual observation, they are considered to be reversible.—Author. (Biological Abstracts)

WESSELS, J. P. H. and A. M. GERICKE.
A COMPARATIVE STUDY OF GROWTH IN YOUNG FOWLS OF A LIGHT AND HEAVY BREED. Union of South Africa, Department of Agriculture, Sc. Bull. 384 : 1-26 (1958).—A small number of White Leghorn and Black Australorp chickens were reared under identical conditions up to 18 weeks of age. Ten chicks were sacrificed weekly and the relative weights of different body parts were tabulated. Australorp chickens were heavier than Leghorns at day old and the difference in weight increased with increasing age. Sex differences were not observed in day old weights. Leghorns displayed the sygmoid growth curve, but Australorps had not yet reached the end of the period of rapid growth at 18 weeks of age. Efficiency in feed utilization dropped steadily from the first week onwards but the rate of decline displayed certain breed differences. Australorp pullets displayed a smaller decline in efficiency after 9 weeks of age than Leghorn pullets.

Dressing percentage gradually increased with an increase in age and this rate of increase was larger in Leghorn and Australorp pullets than in Leghorn cockerels.

WILSON, ROBERT G., and L. M. HENDERSON. (Dept. of Biochemistry, Okla. State Univ., Stillwater, Okla.)
NIACIN BIOSYNTHESIS IN THE DEVELOPING CHICK EMBRYO. Fed. Proc. 19(1 Pt. 1): 416. 1960.—Abstract. (Biological Abstracts)

WIXOM, ROBERT L., SUZANNE W. CONNER, and W. MARCUS RIDDELL. (U. Arkansas Sch. Med., Little Rock.)
BIOSYNTHESIS OF SERINE IN THE CHICK. Fed. Proc. 19(1 Pt. 1): 3. 1960.—Abstract. (Biological Abstracts)

ZAKRZEWSKI, SIGMUND F. (Roswell Park Mem. Inst., Buffalo, N. Y.)
STUDIES ON THE SUBSTRATE SPECIFICITY OF FOLIC ACID REDUCTASE. Jour. Biol. Chem. 235(6): 1780-1784. 1960.—Some folic acid analogues and simple pteridines were tested as substrates of folic acid reductase purified from chicken liver. Pteroylglutamyl-gamma-glutamyl-gamma- glutamic acid, pteroic acid, the 9- and 10-methylated derivatives of folic acid and 2- amino-4-hydroxypteridine-6-aldehyde were active as substrates. N^{10}-formylfolic acid and most of the 2-amino-4-hydroxypteridines were inactive. Of the active compounds, the monoglutamate and triglutamate forms of folic acid had the greatest affinity for the enzyme. Decreased affinity was particularly pronounced with compounds which lacked the glutamic acid residue. The comparison of maximal reaction velocities and structures of the substrates indicated that an electron-attracting group attached a position 6 of the pteridine seems to be an essential feature of the structure of active substrates. On the basis of these observations, a possible mechanism for the enzymatic reduction of folic acid was suggested.—Authors. (Biological Abstracts)

ZAKRZEWSKI, SIGMUND F. (Roswell Park Mem. Inst., Buffalo.)
PURIFICATION AND PROPERTIES OF FOLIC ACID REDUCTASE FROM CHICKEN LIVER. Jour. Biol. Chem. 235(6): 1776-1779. 1960.—An enzyme which reduces folic acid to tetrahydrofolic acid was partially purified from chicken liver. The purifiication involved preparation of the acetone powder from the supernatant of liver homogenate, removal of tetrahydrofolic acid formylating activity by isoionic precipitation of protein at pH 5.5 and 4.5, and fractionation of the supernatant with acetone. The specific activity of the purified preparation was 18 times higher than that of the supernatant of liver homogenate. Optimal activity occurred at pH 5.0. Phosphate and acetate were inhibitory. The purified enzyme had an absolute requirement for triphosphopyridine nucleotide.—Author. (Biological Abstracts)

MANAGEMENT

BAILEY, B. B., J. H. QUISENBERRY, and **J. TAYLOR. 1959.** [Dep. Poultry Sci., Texas Agric. Mech. Coll., College Station.]
A COMPARISON OF THE SUBSEQUENT LAYING HOUSE PERFORMANCE OF RANGE AND CONFINEMENT REARED PULLETS FED ALL-MASH AND MASH AND OATS, *Poultry Sci.*, 38: 559-564.—Over a 308-day period in individual laying cages the performance of 640 pullets from 5 egg production stocks reared by 4 different methods was tested. The following are some of the results obtained. (1) None of the interactions between rearing method and breeding stocks was significant. (2) Over the entire test, range-reared birds produced at an 0.5% higher rate of lay than confinement-reared birds and their egg weight was 1.05 g. better. (3) In the over-all analysis of feed efficiency there was no difference in pounds of feed required to produce a dozen eggs between rearing methods. (4) Confinement-reared pullets required an average of 8.25 days less to reach sexual maturity than range-reared birds. (5) Range-reared birds weighed 91 g. less on an average at 147 days of age, but gained 144 g. more during the laying period. (6) No significant differences in laying house mortality were obtained. (Animal Breeding Abstracts)

BAILEY, B. B., J. H. QUISENBERRY, and **J. TAYLOR. 1959.**
A COMPARISON OF PERFORMANCE OF LAYERS IN CAGE AND FLOOR HOUSING. *Poultry Sci.*, 38: 565-568.—A total of 873 birds representing 4 egg production stocks were used in an experiment to compare the performance of birds in cage and floor housing over a period of 308 days of egg production. In this study it was found that: (1) Egg production of cage-housed birds was 1.3% higher than those housed on the floor. (2) The differences in response by housing method with the 4 stocks were statistically significant. (3) The av. egg weight of cage-housed birds was significantly heavier than for floor-housed birds. The av. egg wieghts were 56.1 and 55.1 g., resp. The larger egg

size in cage-housed birds was consistent in all 4 stocks, but there was a significant difference in response by stock to the method of housing. (4) The av. body weight of the cage-housed birds was 116.4 g. greater than that of floor-housed birds. This difference was consistent throughout the test, and was highly significant. (5) Cage-housed birds required 0.146 lb. less feed to produce a lb. of eggs, and 0.118 lb. less feed to produce a dozen eggs than did the floor-housed birds. These differences were significant and were consistent with each of the 4 stocks. (6) There was no significant difference in laying house mortality between the cage- and floor-housed birds. For cage housing the mortality was 10.35% *v.* 9.39% for the floor-housed birds.—Authors summary. (Animal Breeding Abstracts)

BOBBY, F. C.

DUCK FARMING IN NEW ZEALAND. HATCHING, REARING AND FEEDING. *N. Z. J. Agric.*, 1960, 100, 184-185; 187; 189. (Dept. Agric., Wellington.)—Details of hatching, rearing and feeding are given with respect to the efficiency of production.

Mash is usually fed in small quantities, 5 times a day at age 10 days and gradually reduced to 3 times a day from 6 weeks onwards. The mash should not be wet and sloppy until the birds are 10 days old.

Feed consumption of ducklings is high compared with chickens. The composition of the mash is similar to that of chicken mash with crude protein 18, carbohydrate 55 to 56, and fibre 4 to 5 per cent. Dried skimmed milk and vitamins A and D may be added with advantage. At 3 months, Khaki Campbell ducklings weigh about 3 lb. and have eaten about 17 lb. food; Barred Rock pullet of the same age weighs about 2 lb., having eaten 7 lb. Wheat and kibbled maize may be introduced into the mash at 3 months of age and when the birds are accustomed to the grain it should be fed separately. Adequate water supply is essential at all times.—M. E. Falconer. (Nutrition Abstracts & Reviews)

BRESSLER, G. O., and R. D. ESTEP.

PULLET PERFORMANCE IN THE SOLAR HOUSE AND A WELL-INSULATED CONVENTIONAL HOUSE; 1956-57 and 1957-58. 1. EGG PRODUCTION. 2. MORTALITY. 3. POUNDS OF FEED PER DOZEN EGGS. 4. EGG QUALITY. *Pennsylvania Agri. Exp. Stat. Progr. Rep.* No. 208, September 1959, pp. 4. (Nutrition Abstracts & Reviews)

EDWARDS, H. M. (Jr.), H. L. FULLER, and C. W. HESS.

THE EFFECT OF ENVIRONMENT ON CHICK GROWTH. *J. Nutrition*, 1960, 70, 302-306. (Poultry Dept., Univ. Georgia, Athens.)—The growth rate of chicks reared in an experimental room freshly cleaned and fumigated was greater than that of chicks reared in the same room before fumigation. The requirement of the birds for Mg and Zn appeared to be higher under contaminated conditions.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

COOPER, D. M. 1958. [Houghton Poult. Res. Sta., Houghton, Huntingdon.] Die kunstliche Befruchtung in der Geflugelzucht.

ARTIFICIAL INSEMINATION IN POULTRY BREEDING. *Zuchthyg. FortPflStor. Besam. Haustiere*, 2: 39-41 (English summary.)—Application of A. I. is limited but offers advantages in research and might be applied in Broad Breasted turkeys if mating is difficult.—From author's summary. (Animal Breeding Abstracts)

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS 1960.

REPORT OF THE MEETING OF EXPERTS ON PERFORMANCE TESTS FOR POULTRY, WITH PARTICULAR EMPHASIS ON RANDOM TESTS FOR EGG AND POULTRY MEAT PRODUCTION HELD IN ZURICH, SWITZERLAND, 20-23 OCTOBER 1959. *Meeting Report*, No. AN-1959/4. *Rome: FAO.* i+ 15 pp. (Mimeograph.)—Representatives of 8 countries summarised work in progress or

planned in their countries and the conclusions and recommendations on the operation of random sample tests are set out. (Animal Breeding Abstracts)

GOLDEN, E. F. 1960.

BROILERS. PRODUCTION AND MANAGEMENT. With foreword by C. G. May and chapters by K. Wilson and J. L. Williams. *London: Poultry World.* 2nd ed. 212 pp. [B.] Price: 10s. 6d.—This is the second edition of a practical book on broiler production written by an experienced poultryman. It will be of interest to those engaged in the industry, especially to beginners. A general understanding of the technology which has made this rapidly expanding industry possible is essential to those who would participate in it. Part of the success of the industry is attributable to the application of mass production techniques, and this has only become possible with the development of veterinary practice to the point where large and concentrated populations can be raised with time-table precision. The nutritional and genetic aspects of broiler production, both of which have made enormous advances in the last two decades, are having the effect of removing chicken from the luxury category to that of a cheap source of animal protein for humans. However, without at least an understanding of when to call in the services of the veterinarian, nutritionist or geneticist, or any other appropriate technician, any broiler enterprise is doomed to failure. This book, by sketching in the many pitfalls which await the novice, at least serves this function.—G. A. Clayton. (Animal Breeding Abstracts)

HALE, R. W. 1959. [Queen's Univ., Belfast.]

ABSENCE OF PEN EFFECTS IN LAYING EXPERIMENTS ON A SEMI-INTENSIVE PLANT. *Poultry Sci.*, 38: 739.—As further amplification of published information on the size of errors in annual egg production [*see A.B.A.*, 21, No. 428] results are presented for another flock of White Wyandottes trapnested for 4 yrs. on the same plant under standard methods of feeding and management. There was no significant pen effect in any year, and hatch effect was significant in only one year. (Animal Breeding Abstracts)

HEYWANG, B. W.

ANTIBIOTICS AND THE PERFORMANCE OF WHITE LEGHORN CHICKS DURING HOT WEATHER. *Poultry Sci.*, 1959, 38, 1468-1469. (Animal Husb. Res. Div., Agric. Res. Serv., Southwest Poultry Exp. Stat., Glendale, Ariz.)—Previous trials had shown that the antibiotics given to chickens during hot and cold weather gave variable results (Abst. 409, Vol. 23) and with laying pullets egg production was increased by antibiotics and arsanilic acid (Abst. 1426, Vol. 30).

In the experiment now reported procaine penicillin 4, penicillin 2 with chlortetracycline 5, chlortetracycline 50 or 10 or arsanilic acid 90 g. per ton feed of the progeny of hens which also received these supplements had little beneficial effect on growth or efficiency of feed conversion in an average environmental temperature of 86° F.—J. S. Thomson. (Nutrition Abstracts & Reviews)

KARJUKINA, K. I. Effektivnost razlicnyh sposobov vyrascivanija utjat na mjaso.

EFFECTIVENESS OF DIFFERENT SYSTEMS OF REARING TABLE DUCKS. *Pticevodstvo*, 1959, No. 12, 22-25.—Four groups of 200 ducklings were reared indoors for the first 15 days, with a run outside during the day. After that the first group continued in dry runs. The other 3 groups were tranferred to the shore of a lake which had a sandy bottom and was rich in animal and plant life, and had unlimited access to the lake until 45 days of age. From 46 to 64 days one group were returned to dry runs and given a fattening ration, another group were allowed limited access to the lake and were given the fattening ration, and the remaining group were left free access to the lake and were given a ration with little animal food.

Between 20 and 40 days of age the ducklings kept in dry runs were heavier than those given access to the lake, but by 50 days all 3 groups by the lake had outstripped them. At 60 days the mean weights of the 4 groups, in order as described above, were 1790, 1820, 2130 and 1950 g. For the whole period mean weights of concentrates used per kg. weight gain were 5.2, 4.4, 4.0 and 4.1 kg. The 2 groups given access to water up to slaughter had a higher percentage of edible carcase than the others.

The results of this study and of a practical trial with larger numbers of ducks in the next year were taken to show that it is not desirable to transfer ducks from water to dry runs for fattening. Rearing on dry land is recommended for farms where there is no water for swimming, but it is necessary to provide a better ration and constant supplies of drinking water. For ducks reared on water the best fattening results are obtained by limiting their access to the water for the last 15 or 20 days to about 1 sq.m. to 6 or 8 ducks.—D. Duncan. (Nutriiton Abstracts & Reviews)

KENNARD, D. C., V. D. CHAMBERLIN, E. N. MOORE, and **A. R. WINTER.**

THE USE OF COMPOST (BUILT-UP) LITTER IN CHICKEN HOUSES. *Ohio Agric. Exp. Stat. Res. Bull.* No. 843, October 1959, pp. 31.—A review with 84 references to the value of old litter in producing resistant birds, supplying nutrients and saving protein and saving labour, with a note on maintenance of the litter in suitable condition.—T .D. Bell. (Nutrition Abstracts & Reviews)

KUSNER, H. F. 1960. Effektivnostj razlicnyh form iskusstvennogo otbora v pticevodstve.

THE EFFECTIVENESS OF VARIOUS FORMS OF ARTIFICIAL SELECTION IN POULTRY BREEDING. *Zivotnovodstvo*, 22(4): 71-79.—The literature, mostly Western, on selection and progeny testing is summarised without references. (Animal Breeding Abstracts)

LUCKEY, T. D. (U. Missouri, Columbia.), **M. WAGNER, H. A. GORDON,** and **J. A. REYNIERS.**

REARING GERMFREE TURKEYS. Lobund Reports. 3. 176-182. 1960. (Biological Abstracts)

McARDLE, A. A., M. D. JONES, and **A. G. LOWE.** 1959.

RESULTS OF THE FIFTH EGG TO LAYER SAMPLE TEST 1957-59 HELD AT PARAFIELD POULTRY EXPERIMENT STATION. *J. Dep. Agric. S. Aust.*, 63: 120-123.—The 5th test covered the period 10th Sep. 1957 to 17th March 1959; 230 entries were received for White Leghorns, 175 for heavy breeds, 70 for crossbreds, and 150 from hatcheries. For the 50-wk. laying period the av. production per bird on a hen-housed basis was 190.96 eggs weighing 2.12 oz. Average hatchability of all eggs set was 77.3% and 79.7% of all birds entering the rearing pens were reared. (For the breed averages see *A.B.A.*, 28, No. 351.) (Animal Breeding Abstracts)

McARDLE, A. A. 1959.

THE 1958-59 OFFICIAL SINGLE TEST EGG LAYING COMPETITION. *J. Dep. Agric. S. Aust.*, 63: 71-73.—In the 30th competition held at Parafield Poultry Experiment Station av. production was 200.1 eggs per bird for all entries completing the 52-wk. test. Hen-housed average was 189.5 eggs per bird. The 156 Australorps averaged 208.3 eggs and the 135 White Leghorns 191.9 eggs. New individual performance records were established by an Australorp pullet which laid 291 first-grade eggs, and a Rhode Island Red with 271 eggs, and also a W.L. team which laid 1480 first-grade eggs. (For the 1957-58 results see *A.B.A.*, 26, No. 2153.) (Animal Breeding Abstracts)

MISERSKY, P. Geflugelhaltung in zwei Schichten.

KEEPING POULTRY IN TWO SHIFTS. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 1031-1033. (Nat. Inst. Poult. Husb., Newport, Shropshire.)—A system is described in which 2 flocks of hens are kept in one poultry house, each spending 12 hr. in a sleeping compartment and 12 hr. in a deep-litter compartment equipped with electric lighting.—R. G. Hankin. (Nutrition Abstracts & Reviews)

MORGAN, W. C., and B. J. BONZER. 1959. [South Dakota State Coll., Brookings.]

STRESSES ASSOCIATED WITH MOVING CAGE LAYERS TO FLOOR PENS. *Poultry Sci.*, 38: 603-606.—Productive and reproductive performances of 5 genotypic groups of hens were studied for 8-mth. periods during 2 consecutive yrs. Each year some of the hens from the groups were kept in cages and some were kept in floor pens from Nov. to Feb. The hens were intermingled on 1st March, at which time the floor layers showed little response to the changed environment and the cage layers suffered a drastic decline in production as well as low fertility and hatchability of all eggs set. Probable stress factors which may be involved include social rehabilitation, envirnomental adaptability and the interaction of these factors with genetic constiution.—Authors' summary. (Animal Breeding Abstracts)

MULLER, H. 1959. [Inst. Kleintierz., Karl-Marx-Univ., Leipzig.] Methoden zur Vereinfachung der Fallennesterkontrolle bei Herdbuchhennen.

METHODS OF SIMPLIFICATION OF TRAP NEST RECORDING IN FLOCKBOOK POULTRY. *Tierzucht*, 13: 323-325.—To compare the accuracy of 5 with 7 days weekly trap nesting, the laying records of 730 birds in 101 daughter groups and 1018 birds in 119 daughter groups were investigated. Results indicated that there was only a very slight difference in accuracy between the 2 periods and that 5-day trap nesting was sufficiently accurate for flockbook purposes. (Animal Breeding Abstracts)

NOVIKOV, B. G., E. A. MOSKOV, and L. B. RUDAJA. 1958. Intensivnostj razmnozenija domasnih i dikih ptic v uslovijah razlicnogo svetovogo dnja.

INTENSITY OF REPRODUCTION OF DOMESTIC AND WILD BIRDS UNDER CONDITIONS OF A VARYING RATIONING OF LIGHT. *Dopov. Akad. Nauk ukr. RSR*, 1958 (4): 464-466. From abstract in *Biol. Abstr.*, 1960, 35, No. 416.—A 2-phase daily light rhythm resulted in a considerable decrease in egg laying in young turkey hens compared with that under continuously increased daylight. In older Bronze turkey hens there was no difference in egg laying. In the cock sparrow the cycle of testicular activity was somewhat contracted under a [2-] phase daily light rhythm. (Animal Breeding Abstracts)

PARKER, J. E., and W. H. McCLUSKEY. 1959. [Dep. Poult. Husb., Oregon, Agric. Exp. Sta., Corvallis.]

VOLUME AND FERTILIZING CAPACITY OF SEMEN COLLECTED FROM COCKERELS MAINTAINED IN CAGES AND ON LITTER ON FLOORS. *Poultry Sci.*, 38: 858-860.—Seventeen Delaware cockerels were used. During a 30-wk. period the av. volume of all ejaculates for caged ♂♂ was 1.34 cm.^{3} *v.* 1.33 cm.^{3} for ♂♂ on the floor. There was no conclusive evidence of lower fertility of ♂♂ kept in wire cages. The fertility of eggs laid by pullets inseminated with unmixed semen from caged ♂♂ was 87.1% *v.* 76.2% with semen from ♂♂ kept on the floor. (Animal Breeding Abstracts)

PAYNE, L. F.

TURKEYS GROWN IN CONFINEMENT AND ON RANGE. *Poultry Sci.*, 1959, 38, 1087-1094. (Dept. Poultry Husb., Kansas Agric. Exp. Stat., Manhattan.)—At 8 weeks of age groups of 200 male and female turkeys. Broad Breasted Bronze and Broad Breasted White, pre-

viously brooded together, were transferred to Sudan grass range or to a pole-type house without range. All received the same ration to 26 weeks, the confined groups getting alfalfa hay to compensate partly for the range grass.

Feed consumption per bird over the whole period was slightly higher in the range birds, 87.82 lb., compared with 85.58 lb. for the confined birds. Average weight of both sexes at 26 weeks was 20.10 lb. on range, and 18.88 lb. in confinement. Males on range averaged 1.5 and females 0.94 lb. heavier than those in confinement; the differences were significant. Feed per lb. gain was 4.36 and 4.53 lb., respectively, for range and confinement. Grading of the dressed turkeys showed that on range 90.72 and in confinement 82.38 per cent. were graded A. Feeding and watering the birds on range required about 33 per cent. more labour, which partly offset the difference in weight. It was concluded that turkeys can satisfactorily be reared for meat in confinement in a pole-type house.—J. S. Thomson. (Nutrition Abstracts & Reviews)

ROWE, A. H.

THE ECONOMIC APPRAISAL OF A FARM BUSINESS. A CASE-STUDY OF POULTRY FARMING. *Quart. Rev. Agric. Econ.*, 1959, 12, 61-67.—A poultry farm which was not showing a profit was studied and compared with 12 average farms in the area (of Australia). Farm records showed that egg production and feed per dozen eggs were satisfactory but the proportion of first grade eggs was low, and returns from eggs were lower than average. The fault seemed to lie in an unsuitable system of replacement of culled birds, and high, investment in equipment. It is stressed that in farm improvement there are usually many inter-dependent aspects which must be considered, and if one is overemphasized results will not be satisfactory.—T. D. Bell. (Nutrition Abstracts & Reviews)

SKOGLUND, W. C. 1959. [Pennsylvania State Univ., State College.]

THE EFFECT OF LIGHT, FLOOR SPACE, AND FORM OF FEED UPON CANNIBALISM, BODY WEIGHTS, FEED CONVERSION AND MORTALITY IN BROILERS. *Diss. Abstr.*, 19: 2705-2706. (Animal Breeding Abstracts)

SMITH, J. P. C. 1959.

ARTIFICIAL INSEMINATION OF POULTRY. *Agric. Gaz. N.S.W.*, 70: 600-605, 612.—The techniques of collection and insemination in use at the Seven Hills Poultry Experiment Station are described. Best results have been obtained by dilution 1 : 1 or 2 : 1 with Ringer tyrode solution and optimum fertility by inseminating hens every 5 days. (Animal Breeding Abstracts)

SNYDER, E. S. 1959. [Dep. Poult. Husb., Ontario Agric. Coll., Guelph.]

DUCK AND GOOSE RAISING. *Bull. Ont. Dep. Agric.*, No. 532: 74 pp.—This comprehensive illustrated bulletin describes all aspects of the breeding, production and marketing of ducks and geese. Data included in the booklet have been obtained in the course of experiments carried out at Ontario Agricultural College. (Animal Breeding Abstracts)

SQUIBB, R. L., G. N. WOGAN, and C. H. REED. 1959. [State Univ. New Jersey, New Brunswick.]

PRODUCTION OF WHITE LEGHORN HENS SUBJECTED TO HIGH ENVIRONMENTAL TEMPERATURES WITH WIDE DIURNAL FLUCTUATIONS. *Poultry Sci.*, 38: 1182-1183.—A flock of 56 nine-mth.-old White Leghorns was used; 15 birds were placed in an all-wire cage housed in a clear plastic, air-supported structure, with shade adjusted to cover one-half of the cage, while the other 41 were kept in a standard poultry house and served as controls. Egg production and weight were recorded for 4 consecutive weekly periods during March and April 1959. In the air-supported structure, the birds were exposed to diurnal temperature ranges 2½ to 3 times greater than those in the standard house, and their maximum ambient temperatures during the 1st and

3rd wks. reached 102° and 106° F. resp., levels which have been lethal under field conditions. Neither egg production nor egg weight was affected by the treatment. (Animal Breeding Abstracts)

SZUMOWSKI, P., and E. LETARD. 1959. L'insemination artificielle, chez les volailles.

ARTIFICIAL INSEMINATION IN POULTRY. *Rec. Med. Vet.*, 135: 77-100. [B.]—A detailed description of technique with 4 diagrams and 5 photographs and a discussion of its applications. Results as good as, or better than, natural mating are claimed. (Animal Breeding Abstracts)

WIRTH, H. Bemerkungen zum Thema Intensivaufzucht fur junghennen.

OBSERVATIONS ON THE INTENSIVE REARING OF PULLETS. *Deutsch. Wirtschaftsgeflugelzucht*, 1960, 12, 24-25.—Pullets were reared from chicks on 3 farms. They were given meal and cereal grits to appetite until point-of-lay and were kept indoors or with access to a run for all or part of the time. Vitamins and antibiotics were given. Birds kept indoors weighed more, generally started to lay earlier and had a better laying performance than the others, and losses were fewer. It is recommended that hygiene, ventilation and quality of feed should be good and that 1 sq.m. floor space be allowed per 4 to 6 pullets.—I. R. Anderson. (Nutrition Abstracts & Reviews)

WYNE, J. W., M. G. McCARTNEY, R. D. CARTER, and V. D. CHAMBERLIN. 1959. [Dep. Poult. Sci., Ohio Agric. Exp. Sta., Wooster.]

THE EFFECT OF DEBEAKING AND WING-CLIPPING ON GROWTH AND LIVABILITY OF TURKEY POULTS. *Poultry Sci.*, 38: 881-833.—Groups of Small-type White and Large-type White turkey poults were debeaked at 1 day or 2 wks. of age and also wing-clipped electrically or with surgical shears at 1 day. Similar groups of controls were formed. Small-type White poults gained consistently less weight when debeaked day-old than any of the other 4 groups up to 4 wks. of age. Wing-clipping had no effect on growth, nor had debeaking at 2 wks. Neither debeaking nor wing-clipping had a definite effect on livability up to 4 wks. of age. (Animal Breeding Abstracts)

MARKETING AND POULTRY PRODUCTS

ADRIAN, J. La valeur alimentaire de l'oeuf.

NUTRITIVE VALUE OF THE EGG. *Bull. Soc. sci. Hyg. aliment.*, 1959, 47, 235-258. (Lab. Biochim. Nutrit., C.N.R.S., Bellevue.) (Nutrition Abstracts & Reviews)

AGENOR, F. Le chaponnage chimique a quatre semaines en vue de la vente a huit semaines.

CHEMICAL CAPONISATION AT 4 WEEKS WITH A VIEW TO MARKETING AT 8 WEEKS. *Sect. Aviculture., Serv. Elevage, Dept. Agric. Haiti. Bull.* No. 3, Dec. 1958, pp. 9—There were 2 groups of 25 chickens 4 weeks old, of mixed breeds and strains. Average initial weight was 421.8 g. They were fed in batteries to appetite on a fattening diet with 15 per cent. protein and 950 Cal. productive energy per lb., and one group was given diethylstilboestrol implanted subcutaneously. Average weight when killed at 8 weeks of age was 1191 and 1438 g. for birds without and with hormone. Those given hormone were more uniform in weight, and their flesh was judged superior by a taste panel. They required less feed per unit weight gained and returned a higher profit.—T. D. Bell. (Nutrition Abstracts & Reviews)

ARROYAVE, G., N. S. SCRIMSHAW and O. B. TANDON. El contenido de nutrientes de los huevos de gallinas de cinco diferentes razas.

THE NUTRIENT CONTENT OF THE EGGS OF FIVE BREEDS OF HEN. *Bol. Ofic. sanit. panamer.*, 1959, Suppl. No. 3, 179-183. (Inst. Nutric. Centro America y Panama, Guatemala City.) (Nutrition Abstracts & Reviews)

AUSTRALIA: BUREAU OF AGRICULTURAL ECONOMICS. 1959.
THE EGG SITUATION. NO. 4. *Canberra, A.C.T.: Bureau of Agricultural Economics.* 40 pp.—Australian egg production in 1958-59 was 184.6 million dozen. The commercial production of 94.6 million dozen showed a decrease from the previous year, while the domestic production of 90 million remained the same. This was the first time that commercial egg production had fallen below 100 million dozen since the war, and the decrease was distributed over all states except Queensland. Economic aspects are considered. The situation in the other major egg producing countries is reviewed. (Animal Breeding Abstracts)

BABURIN, V. S. Vlijanie vozrasta i porodnosti petuskov na rezul'tati ih otkorma.
INFLUENCE OF AGE AN BREED OF COCKERELS ON RESULTS OF FATTENING. *Pticevodstvo,* 1959, No. 12, 17-21.—Day-old cockerels were obtained twice, on 3 May and 9 June. The first lot were 250 Russian White and 250 from Russian White cocks and local hens of no particular breed, and the second lot were 225 of each kind. All were fed to the standards of the All-Union Institute of Poultry Husbandry for 60 days on growing rations and 75 of each type were then fattened for 20 days, the early groups in July and the later in August.
The early-hatched chickens reached greater weights than those hatched later and used their feed more efficiently. The crossbred chickens hatched early, reached greater weights and were more efficient than the purebred, but for those hatched later there was no difference in weight and very little in efficiency. Results of carcase analysis are tabulated. There were more first class carcases in the early-hatched groups, and they fetched a better price.—D. Duncan. (Nutrition Abstracts & Reviews)

BAKER, RALPH L. (Pennsylvania State U., University Park.)
INTEGRATED PRODUCTION AND MARKETING OF EGGS. Western Feed and Seed 15(2): 60. 1960.—This article is a condensation of U. S. Dept. Agric. Agricultural Marketing Service Report MRR-322. The degree of vertical integration of 29 eggs producing and marketing firms is covered.—J. F. Harrington. (Biological Abstracts)

BENNETT, GRACE. (Purdue U., Lafayette.)
FLAVOR DIFFERENCES IN BROTHS PREPARED FROM HORMONIZED AND NON-HORMONIZED TURKEYS. Food Technol. 14 (5): 231-232. 1960.—Sensory comparisons by means of triangle difference tests reveal that differences are not caused by mouth feel effects from the differing levels of fat present in the broths. The aroma contribution of the fat does not appear to be enough to allow judges to find a difference between samples. The fat-free broth appears to be the carrier of the flavor difference.—Author. (Biological Abstracts)

BROOKS, J. (Res. Sta., Cambridge, Eng.)
TEXTURE IN FOODS. STRENGTH IN THE EGG. Soc. Chem. Indust. (London) Monogr. 7: 149-178. Illus. 1960.—The strength of the egg shell, the volume and rigidity of the thick white, and the elasticity and strength of the vitelline membrane play an important part in the distribution and storage of eggs. This paper describes methods for the measurement of these properties, and discusses the bearing of results on the factors which determine these properties and such changes as they undergo when eggs are kept.—Author. (Biological Abstracts)

CLARK, J. and A. M. CHALMERS.
COMMERCIAL EGG PRODUCTION COSTS. *N. of Scotland Coll. Agric., Agric. Econ. Dept., Econ. Rep.* No. 86, March 1960, pp. 12.—Of the 18 farms costed there were losses in all except 2 flocks, the first time in 10 years' recording that there has been an average loss. Losses per bird were least with battery flocks, twice as great for deep litter and 3½ times for free range. The main reasons for the losses were a smaller number of eggs per bird and a lower average price received for eggs.

It is emphasized that better management in the rearing of pullets would be amply repaid in the final financial result.—W. Thomson. (Nutrition Abstracts & Reviews)

CORNFORD, S. J., W. P. BLOUNT, P. W. R. EGGITT, and J. B. M. COPPOCK.
STUDY OF THE QUALITY OF FREE-RANGE AND LAYING BATTERY HEN EGGS WITH PARTICULAR REFERENCE TO BAKING. *J. Sci. Food Agric.*, 1960, 11, 115-121. (Brit Baking Indust. Res. Assoc., Chorleywood, Herts.)—There was no difference of commercial importance in the general quality and baking properties, apart from colour of liquid whole egg, in a series of tests over 5 months with eggs from battery hens and from hens on free range, all Light Sussex from the same parent stock.—R. G. Hankin. (Nutrition Abstracts & Reviews)

CZAJKA J. and A. PIETRZYKOWA. Badania nad zmiana niektorych wielkosci fizycznych i chemicznych bialka i zoltka jaj konserwowanych w $Ca(OH)_2$ w zaleznosci od czasu.
STUDIES ON THE CHANGE WITH TIME OF SOME PHYSICAL AND CHEMICAL PROPERTIES OF EGG WHITE AND EGG YOLK PRESERVED IN Ca $(OH)_2$. *Rocz. panstwowego Zakt. Hig.*, 1959, 10, 385-393. Russian and English summaries. (Nutrition Abstracts & Reviews)

Der Nahrungsmittelverbrauch Westdeutschlands. Die Entwicklung des Eier- und Schlachtgeflugelverzehrs.
FOOD CONSUMPTION IN WEST GERMANY. THE DEVELOPMENT OF THE EGG AND TABLE POULTRY MARKET. *Deutsch. Wirtschaftsgeflugelzucht*, 1960, 12, 176-178.—The West German people in 1958-59 did not eat much more total meat and meat products than in the period 1935-38; 53.3 against 52.8 kg. per head per year. The main change in the type of meat was that veal fell from 3.2 to 1.7 kg. and poultry meat rose from 1.7 to 3.1. Egg consumption had risen from 133 to 220 per head, a large increase from the low number of 96 in 1949-50.—D. Duncan. (Nutrition Abstracts & Reviews)

EVANS, R. J., S. L. BANDEMER, D. H. BAUER and J. A. DAVIDSON.
THE AMINO ACID CONTENT OF FRESH AND STORED SHELL EGGS. 4. DETERMINATION BY MEANS OF MICROBIOLOGICAL ASSAY AND CHROMATOGRAPHY ON SULFONATED POLYSTYRENE RESINS. *Poultry Sci.*, 1959, 38, 1394-1397. (Dept. Agric. Chem., Michigan State Univ., East Lansing.)—4. Arginine, lysine, tyrosine, cystine, methionine, serine, threonine and glutamic acid, estimated microbiologically in eggs, showed decreases after storage for 18 months. The experiments lasted from May 1948 to December 1949.
Estimation of 17 amino acids by the method of Moore and Stein (Abst. 4469, Vol. 21) showed no loss, after storage for 16 months, in arginine, serine and threonine. Tyrosine decreased by 16.7 per cent. in yolk but not in egg white. Proline decreased by 20 and 56.6 per cent., respectively. Arginine increased by 100 and 30 per cent. Phenylalanine increased by 25 per cent. in both.—J. S. Thomson. (Nutrition Abstracts & Reviews)

FANGAUF, R. Der Fleischspiegel als Bewertungs merkmal des Schlachtgeflugels.
MUSCLE FORM AS A MEASURE OF QUALITY OF TABLE POULTRY. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 963-965; 985-986.—(a) A series of photographs are presented and diagrams prepared from cross-sections of turkey, goose and fowl carcases.
(b) Further illustrations of cross-sections from pheasant, wild pigeon and wild duck.—I. Leitch. (Nutrition Abstracts & Reviews)

FRY, JACK L., and W. J. STADLEMAN. (Purdue U., Lafayette, Ind.)
EFFECT OF COOKING AND CARCASS PART ON THE METHIONINE AND CYSTINE CONTENT OF CHICKEN MEAT.

Food Res., 25(3): 442-447, 1960.—Using *Leuconostoc mesenteroides P-60* as the test organism and a 6 hr. sealed tube acid hydrolysis, methionine and cystine in chicken meat were found to be stable to the effects of cooking by baking. Significant increases in both amino acids occurred during cooking, apparently due to the fact that the drip lost during cooking contained very small amounts of methionine and cystine, and changed the proportion of the remaining amino acids as a percentage of the N present in the cooked meat. There were no significant differences between individual birds indicating that the use of composites is a valid assay technique. The various parts of the chicken carcass differ significantly in their content of methionine and cystine. Light meat was highest in methionine with 2.97 g/16.0 g of N. Cystine is contained in largest amounts in the liver, the level being 2.12 g/16.0 g of N. Skin was lowest in both amino acids.—Authors. (Biological Abstracts)

HALL, M. D.

TABLE POULTRY: FOWLS, DUCKS, TURKEYS, GEESE. *J. Agric., Victoria*, 1960, 58, 99; 101-103, 105-109. (Nutrtion Abstracts & Reviews)

HANSON, H. L., A. A. CAMPBELL, A. A. KRAFT, G. L. GILPIN and **A. M. HARKIN.**

THE FLAVOR OF MODERN AND OLD-TYPE CHICKENS. *Poultry Sci.*, 1959, 38, 1071-1078. (W. Utilisation Res. Development Div., Agric. Res. Serv., U.S. Dept. Agric., Albany 10, Calif.)—Two breeds of broiler chickens were used, Barred Plymouth Rocks, developed chiefly for egg production, to represent the 1930 type of broiler and New Hampshire × Silver Cornish with rapid growth potentiality to represent the modern, 1956, type. The rations used were representative of those in common use in the 2 periods, that for 1930 containing 20 per cent. protein and 900 Cal. productive energy per lb. and that for 1956 22.4 per cent. protein and 950 Cal. Birds receiving the 1930 ration had access to grass range while those on the 1956 ration were kept in confinement. Groups of each breed received both types of ration.

Growth at all ages up to 16 weeks and efficiency of feed conversion were best with the modern breed on the modern ration and poorest in the 1930 birds on the old ration, the weights being 2241 g. and 1810 g., respectively, at 16 weeks, with feed efficiencies of 2.9 and 3.6 g. feed per g. gain. ....

Meat from the different groups, cooked by different methods, showed no appreciable difference in flavour as estimated by panels of experts. —J. S. Thomson. (Nutrition Abstracts & Reviews)

HARMS, R. H. and **C. R. DOUGLAS.**

RELATIONSHIP OF RATE OF EGG PRODUCTION AS AFFECTED BY FEED TO HAUGH UNITS OF EGGS. *Poultry Sci.*, 1960, 39, 75-76. (Dept. Poultry Husb., Florida Agric. Exp. Stat., Gainesville.)—In a series of experiments to test the effect of variations in dietary treatment on the albumin quality of eggs, estimated in Haugh units, it was found that there was a negative correlation between egg quality and rate of egg production. Egg quality so estimated is thus not a valid comparison when rate of production has been altered by the dietary treatment.—J. S. Thomson. (Nutrition Abstracts & Reviews)

HEYWANG, B. W. and **R. W. LOWE.**

DISCOLORATIONS IN EGGS AFTER COTTONSEED MEAL FEEDING WAS STOPPED. *Poultry Sci.*, 1959, 38, 1471-1472. (Animal Res. Div., Agric. Res. Serv., Southwest Poultry Exp. Stat., Glendale, Ariz.)—Laying pullets were fed for 36 days on rations containing different cottonseed meals giving levels of free gossypol ranging from 0.004 to 0.010 and total gosspyol from 0.132 to 0.280 per cent. Eggs laid on 10 consecutive days were stored for 6 months at 35° F. and then examined for the occurrence of dark discolouration in the yolk and pink

discolouration in the white. The cottonseed meals were replaced for 28 days by soya bean meal and all the eggs laid during this period were stored and tested for discolouration. While cottonseed meal was given, the degree of dark discolouration in the yolk ranged from 4.64 to 5.0 (black), except for 1 sample of the meal, and incidence of pink discolouration in the white was from 38 to 97 per cent. After withdrawal of the cottonseed, discolouration ceased within 10 days even when as much as 0.010 free and 0.280 per cent. total gossypol had been given. No pink discolouration was found in eggs laid 5 days after feeding of cottonseed meal ceased.—J. S. Thomson. (Nutrition Abstracts & Reviews)

HEIJMANS, F. J. 1959. (Bogena Ltd., Rotterdam.) De behandeling van mestkuikens met oestrogene stoffen.

THE TREATMENT OF TABLE POULTRY WITH OESTROGENIC SUBSTANCES. *Landbouwk. Tijdschr.*, 71: 167-175. (B).—A review is given of the more important literature published during the period 1940-58 on the effects of oestrogenic substances on poultry. The author found that hexoestrol implants containing 15 mg. of the active ingredient were preferable to similar implants of stilboestrol, in that they resulted in greater gains (173 g. *v.* 165 g. over a 5-wk. period) and a small deposition of abdominal fat. Both substances had a favourable effect on carcass quality. (Animal Breeding Abstracts)

KARAPETYAN, S. K., and **N. G. MIKAELYAN.**

AMINO ACID COMPOSITION OF EGG PROTEINS FROM HENS MAINTAINED UNDER DIFFERENT LIVING CONDITIONS. *Doklady Akad.Nauk. SSSR. Biochem. Sect.* (Transl.) 126(1/6): 133-135. Illus. 1959. (Biological Abstracts)

KARAPETJAN, S. K. Aminokislotnyj sostav jaicnyh belkov pri kletocnoj i vygul'noj sistemah soderzanija kur.

AMINO ACID COMPOSITION OF EGG WHITE FROM HENS KEPT IN CAGES AND IN RUNS. *Ptícevodstvo*, 1960, No. 1, 31-33.—The proteins of egg white and those of yolk were studied by paper chromatography. No differnece was found between eggs from hens kept in batteries and in runs under similar feeding conditions.—D. Duncan. (Nutrition Abstracts & Reviews)

KOLATAJ, A. 1959. [Dep. Gen. Anim. Breed., Agric. Coll., Lublin.] Zawartosc karotenoidow w zoltkach jaj kur ras zielononozka, sussks i leghorn.

CONTENT OF CAROTENOIDS IN THE YOLK OF EGGS OF GREENLEG, SUSSEX, AND LEGHORN HENS. *Ann. Univ. M. Curie-Sklodowska, E*, 12 (1957): 517-532. (Russian and English summaries.)—A comparative study was made of the content of carotenoid pigments in the yolks of eggs of 3 breeds of fowl: Polish Greenleg (66 eggs from 10 hens), Sussex (57 eggs from 6 hens), and Leghorn (74 eggs from 8 hens). Breed differences were observed in the xanthophyl content of the eggs; in the carotene content there was no essential difference between Leghorn and Sussex eggs. No correlation was found between the quantity of pigment in the egg yolk and rate of laying. There was a negative correlation between the contents of xanthophyl and carotene in Greenleg and Leghorn eggs. Greenleg eggs had the darkest yolks, but the greatest amount of pigment, as calculated on the basis of the mean value for 1 hen, was in the Sussex.—Abstracts of summaries. (Animal Breeding Abstracts)

McDONOGH, S. 1959. [Dep. Agric., Dublin.]

TABLE CHICKEN PRODUCTION. *J. Dep. Agric. (Dublin)*, 55: 88-108.—The prospects and economic aspects of large-scale broiler production in Ireland are considered, and the merits of various crosses are discussed. At Ballyhaise Agricultral School stocks of White Rocks and Dominant White Cornish imported from the U.S.A. as hatching eggs,

are being propagated. Work here and at the Munster Institute is concentrating on the production of fast-growing strains which are pure for absence of pigment. The crosses under investigation are as follows: White Cornish × White Rock; W.R. × Light Sussex and *vice versa;* W.C. × L.S.; W.C. × (W.R. × L.S.).

Sections of feeding and on co-operative production are included. (Animal Breeding Abstracts)

MEHNER, A., H. W. HOHLS and **J. SOMMERFELD.** 1959. [Bundesforsch-Anst. Kleintierz., Celle.] Die Mastfahigkeit verschiedener Huhnerrassen bzw. -stamme.

THE FATTENING ABILITY OF VARIOUS BREEDS AND STRAINS OF POULTRY. *Arch. Geflugelk.*, 23: 1-11. (English summary.)—Investigations on the fattening ability of breeds and crosses of poultry used in Germany *(see A.B.A.* 26, No. 419) have now been extended and a further 2 experiments carried out. In one, which ran for 12 wks. in the autumn of 1956, 6 White Leghorn and 4 Sussex strains each containing 40-50 ♂ and ♀ day-old chicks were tested, and in the other, which took place in the spring of 1957, 3 further W.L. and 5 Sussex strains were tested together with 1 Columbian and 1 White Rock strain. Results are tabulated. Differences within strains were so great that no one strain was clearly superior: although the Sussex strains were better on av. than W.L., some of the latter surpassed many Sussex strains. The Columbian strain was poorer than the average of the W.L. strains tested, while the White Rock strain was better than the best Sussex strain. (Animal Breeding Abstracts)

MERRITT, E. S. 1959. [Anim. Res. Inst., Canada Dep. Agric., Ottawa, Ont.]

DIFFERENCES IN MARKET QUALITY BETWEEN BROILER STRAINS AS EVALUATED BY MARKET GRADING. *Canad. J. Anim. Sci.*, 39: 121-127.—Chicks from 10 broiler strains were randomly alloted and reared at 3 farms. At 10 wks. of age a random sample consisting of 60 birds of each strain, with an equal number of each sex, was taken at each farm, slaughtered and graded for conformation, fleshing, fat and dressing. The number of birds in each grade class was not independent of farm, sex or strain. The 10 strains, ranked on grade scores, tended to rank in the same order at each farm, although the agreement was better for some grade factors than others, and was better when based on ♂♂ than on ♀♀. On a strain rank basis, the grade scores for any one grade were not, in general, indicative of the scores for any other grade factor. Also on a strain rank basis, there was a high positive correlation between breast angle and grade scores for fleshing; body weight was not correlated with grade scores for any of the 4 grade factors, with the possible exception of conformation in the case of ♂♂.—From author's summary. (Animal Breeding Abstracts)

MERRITT, E. S. (Animal Res. Inst., Ottawa, Ontario, Canada.) **J. H. DOWNS, R. BORDELEAU,** and **B. F. TINNEY.**

GROWTH, VARIABILITY OF GROWTH, AND MARKET QUALITY OF BROILERS ON MASH AND PELLETS. *Canadian Jour. Animal Sci* 40(1): 7-14. 1960.—Floor-reared broilers fed a broiler ration in pellet form were heavier at all ages (6, 9, 10 and 11 weeks) than birds fed the same ration in mash form. The percentage difference in weight between mash and pellet-fed birds increased to a maximum at 11 weeks for males and at 10 weeks for females. Four different genotypes (broiler strains) all showed a growth response to pellets although there was some evidence of a differential response. Coefficients of variation of body weight were higher at all ages for pellet-fed birds of both sexes. Females generally had higher coefficients of variation than males of comparable age on the same form of feed. For both sexes there was a slight tendency toward lower coefficients of variation with age. The data also indicated that, on both mash and pellets, separate rearing of the sexes resulted in greater variability than rearing the sexes to-

gether. There were, however, no differences in body weight due to the method of rearing the sexes. Among pellet-fed birds there was a greater incidence of breast blisters and incomplete back-feathering and the latter resulted in down-grading for dressing. Pellet-fed birds however graded higher for fat.—Auth. abst. (Biological Abstracts)

OREL, V., 1958. (Research Institute for Milk & Eggs, Brno, Czechoslovakia). Fluorescence vajecne skorapky ve vztahu k jakosti vajec.

THE FLUORESCENCE OF EGG SHELL AND THE QUALITY OF EGGS. *Sbornik CSAZV, zivocisna vyroba 3,* 8: 623-631.—It is not possible to judge the age of eggs by fluorescence of the shell because in light, especially sunlight, the purple-red fluorescence of fresh laid eggs changes rapidly to blue. In darkness, however, egg shells maintain their original fluorescence for several months. A clean washed shell has only a slightly different fluorescence from non-washed eggs. In many eggs produced by different conditions of light it is practically impossible to distinguish a washed clear shell. If the shell was soiled by mud or manure before washing, brown grey spots remain in the porous shell after washing. In ultraviolet black light it is possible to eliminate washed dirty eggs with a precision of 85-100%. Some fresh laid eggs with a visually clean shell reveal spots in black light. It has been proved that this is caused by microbial pollution of the eggs by excremental liquid. A slight pollution appears by a slight blue and strong pollution by an intensively yellow fluorescence.

Eggs with fluorescence spots undergo with storage a more intensive spoilage than clean eggs. Most of the spoilt eggs had fluoresced with brown and grey spots after washing, least such with yellow and blue spots after excremental liquor. On an average the presnece of spoilt eggs has been found in eggs sorted in black light as without spots by a half less than in non-sorted eggs after cold storage and by two-thirds after storage in lime water.—V. Orel.

OREL, V., 1959. (Agricultural Institute, Czechoslovakia) **J. E. PRISPEVEK Purknye pro hodnoceni jakosti vajec.**

A CONTRIBUTION OF J. E. PURKYNJE TO THE EVALUATION OF EGG QUALITY. *Sbornik CSAZV, zivocisna vyroba, 4,* 7: 537-541.—E. J. Purkynje in his latin work in 1825 "Symbolae ad ovi avium historiam ante incubacionem" writes that the dense egg white liquidfies in the influence of the atmosphere through the egg shell. In his further only Czech published work in 1855 he wrote that the liquefaction of the dense egg white starts already after oviposition and the quantity of dense egg white is the measure of egg age.

Purkynje in his paper writes about egg preservation in lime water and about the oiling of eggs. He recommends the dipping of eggs in hot water so that the egg white coagulates in a fine layer within the shell preventing water evaporation. The principle of this method is registered in the technical literature and we recommend that this method be called "The Purkynje Egg Pasteurization".—V. Orel.

PETERS, G. H. Ausschlachtungswerte beim Geflugel.

SLAUGHTER YIELD OF POULTRY. *Deutsch Wirtschaftsgelflugezucht,* 1959, 11, 935-937.—Four weight classes of Leghorn, Italian, Sussex, New Hampshire and White Rock chickens were studied. Carcase weight, average 86.8 per cent. of liveweight, was greater in males between 900 and 1000 and between 1150 and 1250 g., and in females over 1900 g. Up to 1250 g. Sussex, New Hampshires and White Rocks had highest carcase weights. Total offals, 30.5 per cent. of liveweight, were greatest in the higher weight classes, in White Rocks and Leghorns, and in males; edible internal organs, 5.5 per cent., were also greatest in White Rocks and Leghorns. Dressed weight, 64 per cent., was highest in the heavier weight classes, and in females. Bone weight, 11.6 per cent., was highest in the lower weight classes, in males, and in Sussex, and lowest in Leghorns and Italians. Meat yield, including edible internal organs,

58 per cent., was highest in the heavier weight classes, in females, and in Leghorns and Italians, and lowest in White Rocks. Cockerels with an outdoor run had heavier bone and less meat than those intensively housed. Carcase yields of turkeys, geese, pigeons, ducks and different types of hens and cockerels were compared and are tabulated. Beltsville and Broad Breasted Bronze turkeys gave most meat.—R. G. Hankin. (Nutrition Abstracts & Reviews)

WORLD'S POULTRY SCIENCE ASSOCIATION

Financial Statement

January 1, 1960 to December 31, 1960

	Dr. Japp	*Major Macdoughall*		
		£	s.	d.
Balance January 1, 1960	$ 5,162.93	999	18	2
Receipts				
Memberships	3,059.10	2,981	18	10
Subscriptions	533.65	5	12	9
Back issues and Congress Reports	76.06	0	10	0
Advertising	2,583.67	334	3	17
Transfer from Major Macdoughall	2,800.00			
Total	$14,215.41	4,322	3	4
Expenditures				
Printing and mailing Journal	7,321.79			
Clerical and administrative	854.40	400	0	0
Postage, telephone, telegrams, etc.	264.97	48	11	0
Supplies (stationery, etc.)	317.99	36	9	7
Translations		18	13	3
Commonwealth Agric. Bur.	—	304	4	0
Travel expenses	—	102	12	11
Rebate to Branches	—	725	13	7
Sundry expenses	—	1	13	4
Editor	600.00	—	—	—
Compiling abstracts	165.00	25	12	0
Transfer to Treasurer	—	1,001	6	3
Total	$ 9,524.15	2,664	15	11
Balance December 31, 1960	$ 4,691.26	1,657	7	5
Savings Account Balance December 31, 1960	$21,315.53			

Credit - Tel-Aviv-Bank (Israel £s) - 827.820

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Ministerium für Ernährung, Landwirtschaft und Forsten, Rossstrasse 135, Düsseldorf

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Abbott Laboratories Pty. Ltd., Box 3698 G.P.O., Sydney, N.S.W.

Annand Robinson Proprietary Ltd., 282 Ruttwen Street, Toowoomba, Queensland

Associated Poultry Farmers of Australia, Daking House, Rawson Place, Sydney, N.S.W.

Australian Egg Board, 263 Castereagh Street, Sydney, N.S.W.

Australian Primary Producers Union, 10 Regent Street, Sydney, N.S.W.

Australian Primary Producers Union, Poultry Prod. Sec. (Vic. Div.), 525-527 Collins St., Melbourne, Victoria

Australian Turkey Federation, 76 Norfolk Road, Epping, N.S.W.

Egg and Egg Pulp Marketing Board, 528-530 Collins Street, Melbourne, C.I., Victoria

J. Jackson & Co., Pty. Ltd., 56 Roma St., Brisbane, Queensland

Merck Sharp & Dohme Pty. Ltd., 59 Lisbon Street, Fairfield, N.S.W.

Multiple Incubator & Brooder Pty. Ltd., 89-91 Quay St., Sydney, N.S.W.

Nicholas Proprietary Ltd., 699 Warrigal Road, Chadstone, S.E. 10, Victoria

N. S. W. Egg Marketing Board, Wattle Crescent, Pyrmont, Sydney
Poultry Farmers Assn. of Western Australia, 44 St. George's Terrace, Perth, W. Australia
Poultry Farmers Co-op, Society Ltd., Box 743K, G. O. P. Brisbane, Queensland
Poultrymen & Farmer's Trading Co. Pty. Ltd., 286 Queensberry Street, N. Melbourne, Victoria
Producers Co-Operative Ltd., Carlingford, N.S.W.
Provincial Traders Pty. Ltd., P. O. Murarrie—E. 7, Brisbane, Queensland
Red Comb Association, Inc., 272 Gouger Street, Adelaide, South Australia
Roche Products Pty. Ltd., 1 Barrack Street, Sydney, N.S.W.
South Queensland Egg Marketing Board, Box 489H., G. P. O., Brisbane, Queensland
Supastok Pty. Ltd., P.O. Box 144, Warwick, Queensland
Western Australia Egg Marketing Board, 39 Marquis Street, West Perth, Western Australia
Western Australia Poultry Science Association, A. Avard, Sec., 280 Belgravia Street, Belmont, Western Australia
Whiting & Chambers Ltd., 209 Grote Street, Adelaide, South Australia
William Cooper & Nephews (Aust.) Pty. Ltd., P.O. Box 12, Concord, N.S.W.

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N. V. Hens, 9c Wasserijstraat, Schoten
Philips-Roxane, 37 rue d'Anderlecht, Brussels
Seghers & Co., P.V.B.A., Briel 52, Baasrode

CANADA

Alberta Poultry Marketers Cooperative Ltd., 10207-108 Street, Edmonton, Alta.
Canada Packers Ltd., Feed Division, Edmonton, Alta.
Wm. Scott & Co., Ltd., 1426 Cottrell Street, Vancouver, B. C.

DENMARK

Danmarks Fjerkraeavlerforening, Sortedamsdossering 27, Kobenhaven N.
Landsudvalget for Fjerkraevlen, Roskildeveg 272, Valby

ENGLAND

British Broiler Growers Association Ltd., High Holburn House, 52-54 High Holburn, London, W.C.1
British Egg Marketing Board, Wingate House, 93/107 Shaftesbury Avenue, London, W.1
Distillers Co., (Biochemicals) Ltd., Broadway House, The Broadway, Wimbledon, London S.W. 19
Millers Mutual Association, 21 Arlington Street, London, S.W.1
National Association of Corn & Agriculture Merchants, Cereal House, 58 Mark Lane, London E.C.3
National Association of Poultry Packers Ltd., High Holburn House, 52-54 High Holburn, London, W.C.1
National Chemical Products Ltd., 172/173 Tottenham Court Road, London, W.1
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National Farmers' Union, (General Sec.), Agr'l House, 25/31 Knightsbridge, London S.W.1
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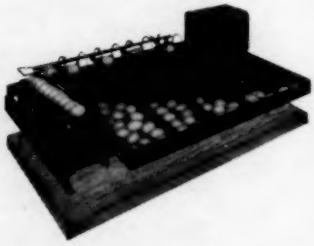

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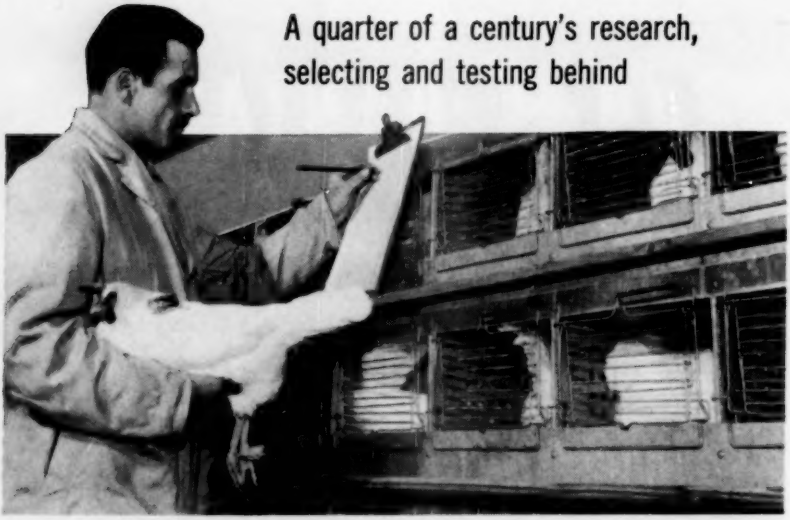

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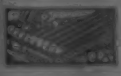

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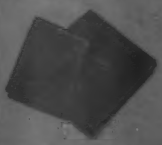

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